

NEW
EXPERIMENTS
AND
OBSERVATIONS
UPON
MINERAL WATERS:

Directing their farther Use
For the PRESERVATION OF HEALTH,
and the CURE OF DISEASES.

BY
Dr. FRIDERICK HOFFMAN,
Counsellor and Physician to the King of Prussia,
and Fellow of the Royal Society.

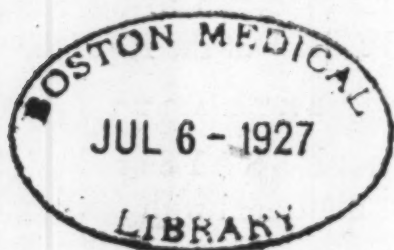
EXTRACTED
From his several ESSAYS upon this Subject, and
illustrated with Notes,
By PETER SHAW, M. D.

Experimentorum longe major est subtilitas, quam sensus ipseus, licet Instrumentis exquisitis adjuti: Itaque Perceptioni sensus immediata ac propria non multum tribuimus; sed eo rem deducimus, ut Sensus tantum de Experimento, Experimentum de Re judicet. Bacon, Verulam.

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T O

D^R. M E A D.

S I R,

AS the Original of this Piece was dedicated to Dr. *Boerhaave*, on Account of his exact Knowledge in all the Parts of Medicine; the same Reason directs the Translation to be submitted to Dr. *MEAD*,

By His

Most Humble Servant,

P E T E R S H A W.

D. M. E. N. D.

The TRANSLATOR'S

P R E F A C E.

THE Importance of the present Subject requires it to be laid before the Publick. Physicians have been long divided upon the Nature and Use of Mineral Waters; but the new Light here given to the Affair, may, perhaps, lead to a Determination. Many Writers extol these Waters above measure; whilst others decry them with no less Vehemence. The Truth may possibly lie in the Middle. To preserve a Neutrality in stating the Question, it should be done, not from the professed Patrons of Mineral Waters; nor from the professed Writers against them; but from such discreet and intelligent Persons as endeavour to do Justice to the Subject, by direct Experiments and Observations.

Dr. Lister and Mr. Boyle were not sway'd by the Authority of the Ancients in this Enquiry; but thought themselves free to examine all a-new. And in the same manner several Members of the Royal Society at London, and of the Royal Academy of Paris, have also proceeded*.

Dr. Lister enquired into Mineral Waters, and their Beds, as a Naturalist and a Chemist; threw
out

* See the Observations of the *Sieur du Clos*, made upon the *Mineral Waters of France*, before the Royal Academy of Sciences at *Paris*; the Original printed at *Paris* in 1675, but translated into *English*, and printed at *London*, 1684. See also the *Philosophical Transactions* and *French Memoirs* upon this Subject.

out a Number of fictitious Principles, which Credulity and slight Observation had loaded them with; examin'd into their Effects upon Drinking; and after many Doubts and Scruples, allows them eminently serviceable in several Distempers; tho' still to be used with Caution and Discretion, to prevent their proving prejudicial; whereto he apprehended they were inclined*.

Mr. Boyle drew up a comprehensive Set of Heads for the Natural History of these Waters; examined the specific Gravities of several; shew'd the Insufficiency and Narrowness of the common Methods of examining them; made many Experiments to discover their Principles or Contents; enquired into their Effects upon Drinking; and concludes, that Experience, upon a Course of using them, can best determine for or against them†.

Dr. Hoffman, after a long Series of Years spent upon the Examination of these Waters; as a Naturalist, a Chemist, and a Physician, declares them the most innocent, general, and serviceable of Medicines; not only from a Discovery of their Contents, their apparent Natures and Composition; but from a successful Course of Experience, in Persons of different Ages, and Constitutions. His Enquiries teach a familiar and easy way of examining the Ingredients of Mineral Waters, and judging of their Efficacy without dangerous Trials; and sets the whole Affair in a clear and advantageous Light; wherein it had not before appear'd, even after the Labours of the French Academy, Dr. Lister, Mr. Boyle, and other eminent Writers upon this Subject.

The

* See Dr. Lister's *Exercitationes duae de Fontibus Medicatis Angliae*; the first printed at York, in 8vo, 1683, and the second at London, 1684.

† See Mr. Boyle's *Memoirs for the Natural History of Mineral Waters*; printed at London, 1685.

*The Author's Abilities are known from his several Works *; there appears an open generous Spirit in his Discourses upon Mineral Waters; and they have been well approv'd abroad. They were originally publish'd separate, at different times; but afterward revised, improved, and collected into one Volume; and in the Year 1726 re-printed at Ulme, in 8vo. They are here contracted, methodized, and more particularly fitted to our Country, by a few additional Notes and Illustrations; so as to prepare the way for a particular Examination of the Mineral Waters of England.*

The Translator would obviate one Objection, whereto he thinks the Author liable, on account of his Severity upon the Physicians, and the common Pharmacy of his Country: but as the Censure is by the Author restrain'd, it should not be extended to other Countries, where there is not the same Occasion.

* Dr. Frederick Slave gives him the just Character of a most excellent and consummate Physician, and a curious Chymist. See Dr. Slave's Account of the Pyrmont Waters, printed at London 1717, p. 58. And Dr. Funcker informs us, that to our Author we principally owe the Chemical Analysis of Mineral Waters; as being the first who successfully detected the antient Errors in this Subject; and manifested the true Ingredients of these Waters by Experiment. See *Funckeri Conspect. Chemicæ. Edit. Halæ, An. 1730: pag. 29.* The principal Works he published in the chemical way, are, *Observationes Physico-Chemicæ. Dissertatio de Generatione Salium. De Nitri Natura. De Cinnabari Antimonii. De Mirabili Sulphuris Antimonii fixati Efficacia. De Mercurio & Medicamentis mercurialibus. Annotationes & Additamenta in Poterii Opera.*

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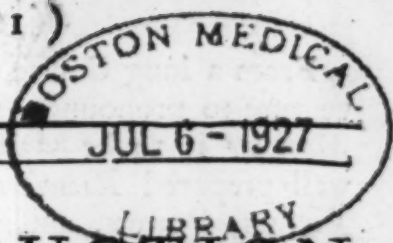
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I N T R O -



INTRODUCTION.

THERE are three Things essential to a *Physician*. The *first* is, a Knowledge of the true and original Causes of Distempers ; so as clearly to conceive in what Manner, and by what pernicious Properties they act, and disturb the Frame of the Body, or the necessary Motions of Life and Health ; and how, through the Connection and Dependence of one Part upon another, these Causes frequently produce others, and a Variety of *Symptoms*.

The *second* is, after a perfect Historical Knowledge of the Circumstances, the Causes and the Symptoms of a Disease, to discover the proper *Remedies* for the Cure.

The *last* Thing is, a Knowledge how to administer and apply these *Remedies*, with Prudence and Discretion, according to different Circumstances, in the proper Season, Dose, and Order.

And as the Art of curing, or preventing, Diseases, turns entirely upon the *Remedies* the Physician uses, as so many Instruments ; he must of necessity apply them skilfully, be well acquainted with their Virtues, Powers, and Principles of Action, and know what Changes they will produce in the Body, whilst they perform their Office ; otherwise he proceeds at Random, and can have no solid Hopes or Assurances of Success.

From a long Course of Experience, I may venture to pronounce, that the *great Secret in Medicine* is to be Master of a few select and well prepared *Remedies*; to understand their Virtues, Powers, and Effects in different Constitutions; and to be well assur'd, in all Cases, what they will and what they cannot do. He, and only he, who has this Talent, both in Theory and Practice, can be allowed an accomplished and successful Physician. Accordingly, it was excellent Advice which *Damascenus* gave to his Son, “ *Let the Remedies you employ be few, and certain; for the use of a Multiplicity so distracts the Senses, that a Physician can safely depend on none.* ”

But it is greatly to be lamented, that of all the vast Number of Physicians, so very few should thoroughly understand, as they ought, the Powers and Effects of the *Medicines* they prescribe: Whence those infinite Volumes, which are stuffed with the *Materia Medica*, infinitely combined. And though the Authors launch into high Encomiums of the Virtues, Uses, and Excellences of these Remedies in particular Distempers; yet Experience, which is the true Test of all Things, declares such Praises false; and that both the Patient and Physician are hence generally disappointed in their Hopes and Expectations.

The Reason why this most useful, and necessary Knowledge of the Virtues and Efficacy of *Remedies* is so much slighted, seems principally because the Antients, and many of the Moderns, remained unacquainted with the *Elements of chemical Philosophy*; so that they could not properly examine the Texture and Composition of the *Simples*; nor arrive at the Art of discovering the Principles whereof they consist:

confist : Whence they never obtained a previous Knowledge of their Virtues, before they prescribed the Things.

Again, they prevent themselves from learning the true Virtues and Effects of the *Simples*, by the crowded Manner, Variety, complex Mixture, and Unsteadiness wherein they prescribe them : Which renders it impossible to form a true Judgment of the Virtues and Powers of any one Ingredient. And being also destitute of a sure Foundation whereon to rest, or fluctuating in the greatest Uncertainty, 'tis customary with them, if a *Medicine* has not presently the desired Effect, to order other Compounds from the Shop ; and these proving ineffectual, others again : inso-much that if the Patient should happen to recover, they know not, in such a Variety of Medicines exhibited, to which the Cure was owing ; so as upon the like Occasion, successfully to employ the same again. And hence the Lord Bacon very justly calls *Multiplicity of Remedies the Child of Ignorance* ; and with exact Discernment censures Physicians in these apposite Words. *To see the daily Labours of Physicians in visiting, bustling, and prescribing to their Patients ; a Spectator would imagine that they diligently prosecuted the Cure, and went directly in a certain beaten Track about it : But whoever looks attentively into their Prescriptions and Directions, will find that the most of what they do is full of Uncertainty and Irresolution, without any certain View or Fore-knowledge of the Cure*.*

Of this Truth we have a *singular Instance* in the Business of *Mineral Waters* : Which though famous for so many Ages, and recommended by Thousands of eminent Examples, are ne-

B 2

vertheless

* See *De Augment. Scientiar. & Histor. Vita & Mortis.*

vertheless discredited by the Ignorance and Unskilfulness of *Physicians*. For, to examine the Writings both of the Antients and Moderns upon the Subject, they give us nothing but amusing and idle Fables about the Principles wherewith they phantastically imagine these *Waters* impregnated; insomuch, that there is not a Metal, a Mineral, or a Salt, that they do not idly pretend they contain: And hence judge very doubtfully about their Uses; and know not from whence their Virtues proceed.

Thus it has been a current Opinion, that *Mineral Waters* abound with a *Vitriolic Acid*; and upon this account *Physicians* have absolutely forbid the use of Milk in the drinking of them. Many have asserted the *Vitriol of Iron* to be their essential Ingredient; and to such a length some have carried the Notion, as to assert, that the predominant Principle of all *Mineral Springs*, is this same *Vitriol of Iron*. Others, with as much Boldness as Falshood, assert they contain Matters disagreeable and prejudicial to the human Body. In short, such erroneous Opinions are deeply fixed in the Minds of most Physicians; whence they generally fancy these *Waters* unsafe and violent in their Operation; and therefore prohibit all such Patients the use of them, as are either weak, very young, old, of infirm *Viscera*, or phthysical: And pretend that they are scarce ever to be used, but in obstinate and inveterate Cases.

Upon observing the Prevalence of this Notion, I diligently examined most of the *Medicinal Waters*, in my own Country, by various chemical, and philosophical Experiments; as by Mixture, Distillation, Exhalation, Weight,

Weight, &c. in order to discover their Nature and Principles. And in the Issue my Labour was not disappointed ; for upon an exact Scrutiny I found that all the *Acidulae*, or cold and brisk *Mineral Springs*, contain not an *Acid*, but a pure *alkaline Salt*, which would raise a Conflict with any *Acid* : That no *solid Vitriol* is procurable from any of these *Waters* : That *Milk* mixes kindly, agrees well, and proves of Service in a Course of the *Acidulae* ; so to be thus drank, with the greatest Safety, even by phthysical Persons : That the Virtue of *purging Waters* depends upon a certain *neutral, cleansing Salt*, composed of a subtile, chalky, or *calcareous Earth*, and a *Mineral Acid* : That both *hot* and *cold Waters* have a Correspondence in their Principles and Virtues ; and are neither prejudicial to the weak, young, or old, Women with Child, or Persons recovering from acute Distempers : And lastly, that the Efficacy of *Mineral Waters*, in opening inveterate Obstructions of the *Viscera*, &c. has a great Dependence upon the Quantity and Goodness of the mere *Water* ; and that many of them have not the least pernicious Quality.

To set this Matter in its just Light, and enable every Person to form a solid Judgment thereof ; we shall here deliver the Sum of the Doctrine whereto our *Observations* and *Experiments* lead.

(1.) And first it appears, that *Mineral Waters*, both of the hot and cold Kind, are of such Virtue and Efficacy, for the Preservation of Health, and the Cure of Diseases, as in the highest Degree to exceed the Shop Remedies, prepared by the nicest Art : And we are well

assured that this Fact cannot be disputed, but by such as derive their Arguments from their Ignorance or Indolence ; and are no way competent or experienced Judges in the Case.

(2.) These *Waters* approach the nearest of any thing in Nature to what has been so much searched after, an *universal Medicine*, suited to the Cure of all Diseases. But there is no occasion for any such laborious Enquiry, whilst we find *Waters* adapted to all kinds of Disorders, spontaneously offer themselves. And I would fain know whether any Physician, of practical Knowledge and Experience in his Art, can say of any other Medicine, what we certainly know to be true of *Waters* ; viz. that they effectually cure, both with Expedition and Safety, yet occasion no loss of Strength ; but gently operate by all the Outlets of the Body ; and thus discharge at every Pore, the Matter which generates, and breeds Diseases. For these *Waters* not only readily dilute, propel, and carry off Collections of impure Humours, lodged in the Stomach and Intestines ; but likewise admirably promote the Discharge of all peccant, saline, and unctuous Matter, by the Conduits of Urine : And at the same time breathe out the more subtile and rarified pernicious Particles, by that general Strainer of the Body, the Skin.

(3.) These *Waters*, besides their Power of evacuating, are also possess'd of a singular alterative Virtue ; insomuch, that there is no other *Remedy*, hitherto known, so fit for dissolving down viscid and clammy Humours, diluting and tempering such as are sharp and corrosive, correcting and changing such as are acid and austere ; and for opening and breaking away Obstructions and Coagulations in the
finer

finer Vessels. Add to this, that they have a most desirable, strengthening Virtue ; whereby they nobly brace up, and recover such solid Parts of the Body as have lost their natural Tone or Springiness, or become slack and remiss. And what is more extraordinary, they produce all these good Effects, without occasioning any subsequent Mischief ; and therefore may, with the utmost Safety, be given, not only to Persons in a state of Health, but even to those in the weakest Condition, Women in Child-Bed, old People, and Children. In short, they have also this Particularity, that they may be innocently and advantageously used in different Constitutions, and Ages, at all Seasons of the Year ; not excepting the Winter itself.

(4.) What is still more wonderful, but no less certain, every *capital Mineral Spring* seems endowed with quite different Virtues ; so as to produce contrary Effects. Thus, if the Excretions of the Body are too large, these *Waters* check them with Safety ; or if they are too small, the very same *Waters* will effectually encrease them. Again, if the first Passages, particularly the Stomach and the *Duodenum*, be over-loaded with a bilious Matter, they without Violence discharge it by Vomit ; and on the contrary, soon cure that stubborn and violent Vomiting wherewith hypochondriacal Persons are sometimes afflicted. So likewise, if the menstrual or hemorrhoidal Flux be too large, stopped, or observes not its natural Periods ; there is no better Remedy hitherto discovered than *Mineral Waters*, for bringing these Disorders to rights.

(5.) Another singular Instance of Design, Wisdom, and Goodness, in *Mineral Springs*, is that they have this Advantage above most other Things ; that they are not apt to lose their Virtues, or fall to Ruin and Decay. For though this has sometimes happened, yet the more capital and serviceable *Springs*, of medicinal Use, have certainly retained their Virtue, through the Course of many Ages ; and afforded a sufficient Quantity of *Water*, even in the hottest Seasons ; whilst other common *Springs* have been dried up. They have also continued to abound with the same Quantity of *Principles*, or Ingredients of the same Quality, in an equal Proportion of the *Water*. And lastly, though the Bowels of the Earth, through which these *Waters* run, are pregnant with *Metals* and *Minerals*, some of them prejudicial and poisonous to the Body ; yet the *Waters* of these *Springs* dissolve and drink up none of this kind : But as if directed by an Appetite of Choice, impregnate themselves with only such *Principles* in their Passage, as render them highly agreeable to the Solids and Fluids of the human Body.

Since, therefore, there are so many Advantages derivable to Mankind from *Medicinal Springs* ; whence they were held *Sacred* by the Antients ; who can help wondering at the supine Indolence and Neglect both of Philosophers and Physicians, in not examining into their Principles, Operations, and Effects ? The greatest Part of the Authors upon this Subject seem to have wrote hood-wink'd ; so as not to have seen the real Principles and Ingredients of these Waters : But on the contrary, to have imagined in them Matters whereof they could trace not the least Marks

Marks or Signs. Whence it has happened, that not only the Physicians upon the Spot, but those likewise of other Countries, who had not the Opportunity of examining our *Waters*, have held them very suspect, precarious, and dangerous ; and therefore advised their use only to the robust, the strong, and the healthy : Being very apprehensive of doing Mischief at least, if not occasioning sudden Death, by prescribing a Course of *Waters*, which they thought abounded with the Principles of so many Minerals, opposite and destructive to the human Body ; unless all the Parts thereof were perfectly sound and entire. In this Point, however, such Physicians have not acted consistently with themselves ; for their Custom has been to make these *Springs*, as it were their last Resource for the Cure of chronical Disorders ; which had reduced the Patient to the utmost Extremity, after all other Remedies failed : as if Persons, who had so long laboured under inveterate Diseases, could be supposed to have their *Viscera* sound and untainted. Such Physicians, therefore, notwithstanding all the Darkeness and Distrust which may hang upon their Minds in this Matter, must acknowledge that *Mineral Waters* cannot, at least, but be innocent, if they here do no Mischief ; or highly serviceable if they effect a Cure, in Bodies so worn out and weakened by a Distemper : Though they should not understand the Reasons whereon the Thing depends ; which it will be the Business of the following Sheets to unfold.

And if I shall have made any useful *Discoveries* in this Subject ; what led me to them was a firm Resolution, to take nothing upon Trust ; nor measure the Skill of Physicians

Physicians by popular Opinion ; but my self to try, as far as my Abilities went, and examine every Thing by the Rules of Reason. And finding, by *Observation* and *Experience*, the superior Excellence and Usefulness of *Mineral Waters* in the *Art of Medicine*, I thought my self obliged to prosecute my *Enquiries* with a Caution and Exactness proportionable to the Importance of the Affair. Thus by withholding my Assent to the received Notions upon this Head, and coming personally to examine into the true *Nature*, *Principles*, and *Virtues* of these *Waters*, by the means of *chemical and philosophical Experiments* ; I found the greatest Part of what had been said of them by Authors, to be false and fictitious. And being once thoroughly convinced of this, I held it incumbent upon me to oppose the Errors every where strongly prevailing to the Disadvantage of the *Art* I profess ; and support my own *Discoveries* with all the Light and Strength of Reason I could give them. And in the Course of these my *Enquiries* and Endeavours, I have happily discovered certain *Springs* of uncommon Virtues ; and advantageously introduced them into Physick. And if others will proceed in the same or a better Manner, I question not but their Labours will be crowned with the same or better Success : Which is what I earnestly wish for the Benefit of Mankind.

S E C T. I.

Of Water in general: Or, the Ways of determining the Wholesomness, Goodness and Excellence of all Waters; without any dangerous Trials upon the human Body.

I. **T**IS a great Unhappiness that Men should lightly esteem such things, which tho' ever so necessary and useful, are common; and not examine into their Natures, Properties, and farther Uses. Thus, tho' *Mineral Waters* are certainly endowed with great *medicinal Virtues*, even so far as to render all other Remedies in a manner unnecessary; yet they have been very little examined, or used as they deserve. We cannot, therefore, but earnestly recommend the due Prosecution of this Subject to all such as are more concerned for the Health and Prosperity of Mankind; than for establishing an *Art* upon human Infirmities. To discuss this Matter in some tolerable degree, and enable People to assist in the Cure of their own Diseases, is the Intention of the present *Essay*; wherein we propose to deliver our selves in an easy and familiar manner, for the general Good.

2. All Countries abound with *medicinal Springs*, suited to the Cure of numerous Diseases; whilst the Names, the Virtues and the Uses of such *Waters* often remain unknown to the Physicians and Inhabitants of those Countries. And tho'

Mineral Waters, whence little understood.

tho' it has been a general Practice to frequent certain *Springs* at particular Seasons of the Year; yet the Physicians, and others, who have wrote in Recommendation of their Virtues and Uses, have commonly done it in an ignorant, illiterate and inartificial manner; without the least Tincture of what is herein so requisite, a Knowledge of *Chemical Operations*, and the way of making judicious philosophical Experiments: insomuch that they have delivered us strange Dreams of *Waters* impregnated with *Gold, Silver, Antimony, Arsenick, Sealed Earth, Sal-ammoniac, Bitumen*, and a thousand other things; in direct Contradiction to Experience and Observation.

3. No less preposterous has been their manner of prescribing such *Waters*; which they do in the perfect manner of *Empiricism*, without the least regard to their Virtues and Efficacy, or the Causes of the Distempers in which they direct them: So that *Mineral Waters* seem the principal and more immediate Seat of *Quackery* *. And if the rational and philosophical Physicians, as they affect to be called, desire in earnest to clear their Conduct, and wipe off this Reproach, let them shew, by their Practice, that the Virtues and Efficacy of Remedies do not more depend upon the Remedies themselves, than upon the Disposition of the Bodies whereon they are intended to act. And when they meddle with *Mineral Waters*, or take upon them to point out and direct their Use; let them not praise or dispraise them in general Terms, but enumerate the necessary Circumstances and particular Cases wherein they may

* The Reader may please to observe, that the Scene is all along *Germany*, not *England*.

may or may not be serviceable; and lay down such Rules and Observations as tend to some certain Issue. In order to lead them the way, we will here proceed, not upon general Conjectures; but write from a long Series of Experiment and Observation.

4. And first, we understand by *Mineral Waters*, not only such *hot and cold Springs* as have already acquired a Reputation, and are therefore much frequented; but likewise all others, that manifestly partake of a *Saline or Mineral Nature*: of which there are infinite numbers; as if Providence had dealt out, with a liberal hand, ready and easy Cures for all the Distempers with which Mankind is afflicted *. Our primary Care shall therefore be to deliver *Methods and Rules* of examining the *Wholesomeness or Unwholesomeness*, the *medicinal or pernicious Properties* of all kinds of *Waters*; without the Necessity of making any dangerous Trials with them upon the human Body.

5. By the Term *Wholesomeness*, we mean that which no way hinders or impairs the natural Actions of the Body; but has a direct Tendency to promote, strengthen and confirm them: and of this kind are all those things which forward, continue and secure the Offices and Actions of the Parts of the Body. The Cause of this depends upon the natural Frame and original Structure of the Parts; and, in a more active and eminent Degree, upon that extremely *fluid and fine Matter* of the Body, called by the Name of *Spirit*; which resides in every

* *England* abounds in *Mineral Springs* of all kinds; and any one may be easily instructed to discover them, and examine their Virtues and Uses; as will be made manifest in the Course of this Work.

every Part ; and, so far as the present anatomical Discoveries reach, is principally separated in the fine Canals and winding Vessels of the *Brain* and *spinal Marrow* ; and thence convey'd to all the Parts by the porous and spongy Substance of the Nerves ; in order to give Strength, Vigour and Motion to the Solids ; Mobility, intestine Motion, and a spirituous Nature to the Fluids ; preserve their Texture entire, and defend them from Corruption. So long as this *Fluid* remains in its due and proper State, the Body is healthy, firm and stable ; and all the Actions and Offices of the natural Life duly and properly exercised and performed. But as the *natural Actions of Life* cannot remain perfect and entire, unless the Humours are rendered sufficiently thin and fluid, to flow thro' the smallest capillary Vessels ; and unless the useles droffy Parts are separated and discharged by the open Orifices of the Vessels, both of *Secretion* and *Excretion* ; whatever preserves the Juices in their entire and perfect State, and promotes these *Excretions* in the respective Vessels, is deservedly called by the Name of *healthy* or *wholesome* : as on the contrary we justly term that *unhealthy* or *unwholesome*, which is opposite to the Nature of the *Spirits*, prevents their Separation, Formation and Recruit ; disturbs their Motion, renders the Juices thick and sily, shuts up the finer Pores and Passages of the Body, and stops or retards the Business of Secretion and Excretion *. Having thus settled the precise Notion of *wholesome* and *unwholesome*, and shewn whereon

* This Matter is firmly established by the Lord Bacon, in his *Natural History of Life and Death*, and prosecuted by many of the modern Physicians ; but especially Dr. Boerhaave of Leyden, in his *Institutiones Medicæ*.

whereon the thing depends ; we proceed to enquire into the Causes of *Wholesomness* and *Unwholesomness* in *Waters* : And the better to conduct us herein, we shall examine their *various Contents* ; or the different Parts whereof they consist.

I.

OF THE SPIRIT IN WATERS.

6. All *Water* to the Eye appears as one *The Con-* simple uniform *Fluid*, consisting of Parts of *tents of* the same Kind ; whence it was by some of *Waters.* the Antients, and particularly *Thales*, esteemed an *Element*, or the *first Matter of all Things*. But when we come to examine more narrowly into it, *Water* will be found a Composition of Bodies of different Kinds and Properties. Thus 'tis evident, that *Waters* differ greatly among themselves, both in Taste, Weight, and many other Particulars ; so that some of them are fitter than others for different Uses, and the common Occasions of Life. This Difference plainly shews, that *Water* is not a Body of one and the same constant Nature ; but containing different Ingredients, in a different Mixture and Proportion thereof, in different *Springs, Rivers, &c.* And to examine the real Principles of *Water* in general, this Fluid appears from Experiments and Observations, to be a Composition (1.) of a very *subtile Matter*, of a truly elastic or expansive Nature : And is in all Probability an extremely moveable or subtile *Æther*, * whereof there are numerous Instances ;

* Let not this be supposed a *fiction Principle*, till all the Experiments hereafter produced to manifest it, have been considered.

Instances ; (2.) of *Moisture*, or what for Distinction's sake may be called *Elementary Water* ; and (3.) of a *solid Body*, whether of an *earthy* or *saline Nature*. This *Æther* appears to be the Cause of the intestine Motion of the Parts of the whole Fluid, the Facility wherewith the Globules roll over each other, the Origin of its truly spirituous Part, and what preserves it from Putrefaction. The *Elementary Water*, which has the greatest Share in the Composition, serves as a *Vehicle* to lodge, detain and convey the *subtile Matter*, and is composed of very polite, smooth and yielding Particles ; by means whereof it readily enters the Pores of Bodies, and drinks in and closely embraces any Particles of fine earthy or saline Matter. And, accordingly, this fine *earthy* or *saline Matter* seems rather to be an accidental than a real constituent part of *Waters* ; tho' in effect there is no *Water* to be found that does not contain some Portion of a dry and solid Matter. For if the finest and purest *Water* be ever so often distilled, it still leaves some small Quantity of a dry and solid Matter behind it. So likewise if the purest *Water* be froze into *Ice*, and this *Ice* melted again, it constantly leaves a gross earthy part behind it *.

7. The different degrees of *Wholesomeness* and *Unwholesomeness* in *Waters*, together with their *medicinal Virtues*, may properly be judged of from the Nature, Mixture and Proportion of their *Contents*, or the *three different Parts* into which we have distinguished them, upon the

* Some late Philosophers have produced Experiments and Reasons to shew, that the purest Water is no other than a *Fluid Earth*. See in particular *Boyle*, *Becher*, *Newton*, and *Stahl* upon this Subject.

the footing of a philosophical Resolution, or gentle *chemical Analysis* : which does not alter their Nature. And in Fact, we find, that *Mineral Waters* differ considerably according to the different Proportions of *Spirit*, or *ætherial elastic Principle* they contain ; which either in a greater or less Degree is found in them all. But they differ much more in respect of their *solid, saline, or earthy Element* : For as most *Waters*, in their Courses thro' the Earth, imbibe and become impregnated with the *Salts*, or *earthy, Mineral Matters* they wash ; they must of Necessity, when they come to the *Spring-head*, retain many of the fine Particles they licked up in their Passage. And to discover by proper Experiments, and render visible or sensible, these more accidental Ingredients of *Mineral Waters*, which distinguish one *Spring* from another, and give particular *Virtues* to them ; is the proper Business of Natural Philosophers and Physicians.

8. The first *Enquiry* to be gone upon, is *The Signs* the *Marks, Signs and Characters of Wholesom- of Wholesom- ness and Unwholesomness in Waters.* And here *ness and Unwholesomness in Waters.* we lay it down as a certain Rule, that those *Waters* are most excellent, and powerful in the Cure of Diseases, which are most spirituous, or largest furnished with what we call the fine *elastic* part or *Element*. And this capital Property may be discovered by *Specific Gravity of* many infallible Marks. Thus their *Lightness*, or less Degree of *specific Gravity*, is a *Waters.* sure Test and Standard of their *Spirit* : For as *Air* and *Æther* prove principal Causes of Rarification, so do they likewise of Levity. This Position receives abundant Confirmation from Experiment, and has been well
C observed

observed by a Writer on the *Spaw-Waters*,
 * who relates, “ That the *cold Springs* which
 “ are fullest of Spirit, or, as he calls them,
 “ sulphureous Exhalations, prove much the
 “ lightest upon the Balance; as principally
 “ appears in the *Waters* of the *Spaw*, taken
 “ from that Spring called *Savenir*, at some
 “ Distance from the Town; where the
 “ *Water* is much lighter, stronger, and quicker
 “ in its Operation than the *Water* taken from
 “ the Spring in the Town. But this strongest
 “ and most spirituous *Water* cannot be car-
 “ ried from the Spot without great Diminu-
 “ tion of its Virtue, nor so much as be
 “ brought half a Mile to the Town without
 “ losing its Spirit; and consequently, increa-
 “ sing its *specific Gravity*.” And this is not
 only true of the *Spaw-Water*, but confirmed,
 by Experience, of the *Waters* of all cold and
 brisk *Mineral Springs*.

9. Precisely to determine the *specific Gra-
 vity of Mineral Waters*, is a Matter of consi-
 derable Nicety; but may readily enough be
 done for Practice, by means of a well made
Water-poise, with a hollow Ball and Stem; or
 a hollow graduated Cylinder of Brass; or still
 better, by means of a Glass Tube fill'd with
Water, the open End whereof is plunged into
 a Parcel of other Water: for a Fluid, as is well
 known, immersed in another, specifically lighter
 than it self, will descend, and the other rise in
 its Place: So that, for Example, if a Glass
 Tube of *Water* be plunged into *Wine*, the
Water will sink out of the Tube, and the
Wine rise up: which suggests a very agreeable
 way of trying the *specific Gravity of Waters*;
 and at the same time entertaining the Eye
 with

* Gæringius in Descriptione Spadan. p. 15.

with a Sight that demonstrates the Thing. For if we suppose any Difference in the Gravity of two *Waters*, and desire a Proof thereof; 'tis but tinging that imagined to be the heaviest, with *Saffron*, *Cochineal*, *Brazil-Wood*, or the like; filling the Tube therewith, and inverting it into a Glass of that supposed the lighter. But several mechanical Instruments might be invented to determine this Matter in a different Manner. However, great Caution must be had in the use of the *hydrostatical Balance*, and the common *Water-poise*; which tho' they may serve very well for examining the *specific Gravities of Wine, Beer, common Water, salt Water, Lixiviums*, and the like; yet such Experiments are very apt to miscarry, in examining the *Waters of cold and hot Medicinal Springs*, on account of the copious *elastic Spirit* these Waters contain; whence they are ever apt to rise in Bubbles about the Instrument, and buoy it up*.

10. The Lord Bacon judges the best *Water* <sup>The Good-
ness of
Waters
known by
their
beating,
cooling,
and their
SPIRIT</sup> for all common Uses is that which evaporates fastest by boiling over an equable Fire; and Experiment confirms the Observation: For the greater the Quantity of *Spirit* lodged in *Waters*, the more they are internally agitated, expanded and rarified; and the smaller and more subtile the Particles of *Water* prove, the sooner the whole exhales or flies off in Vapour: principally upon account of the internal Motion. *Hippocrates*, in like manner, pronounces that the lightest and best *Water* which is soonest heated and soonest cooled. This Assertion is likewise backed with Reason; especially if we allow, what has been antiently,

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and

* See, for Direction in this Particular, *SECT. II.*
ad finem.

and of late, rendered exceeding probable, that Heat is no more than a violent shuddering Motion of the *Æther*; whence the more of a fine spirituous *ætherial Matter* is contained in *Water*, the sooner it grows *hot*, or comes into such a kind of intestine Motion. And when *Water* once heated suddenly grows cool again, this also is an Indication of its Lightness; as the cold Air enters easier into Bodies of a light and spongy Texture, and thus puts a stop to the shuddering Motion or Cause of Heat; than into dense and close Bodies, which therefore longer retain their Heat.

The Bubbles they afford.

11. Again, those are certainly the *wholesomest* and most *excellent Mineral Waters*, which, when taken up at the Spring-head, throw out a most numerous parcel of *Bubbles*; that first collect themselves at the Bottom of the Glass, then rise in a cluster to the Top; or else beset the Rim of the Glass like so many Pearls. And this Observation affords a very sure *Rule*; as in the greater plenty these *Bubbles* rise, the greater Virtue and Efficacy the *Water* has. For indeed these *Bubbles* are nothing else but the *subtile, ætherial Substance* residing in the Pores of the Fluid: And as the natural Compression of the *Atmosphere* cannot hinder the Expansion of the *Water*; they immediately, upon the Motion of the Liquor, being freed from the Restraint which before confined them, endeavour to extricate themselves and fly off. And hence it is that if the *brisk spirituous Waters of cold Springs*, when kept in a Bottle, of which they fill only two Thirds, for Example, come to be disturbed or briskly d, teitaga and then opened of a sudden; they with great Force emit a pure Vapour: Or if filled to the Neck, the *Water* flies out, to a great Height,
in

in a considerable Quantity. For by such shaking the fine *elastic Substance* contained in the *Water*, is put into a very nimble Motion; and its Spring or Expansion being hindered by the Stopple, as soon as that is removed, it breaks forth in a sudden Gust, and sometimes violently tears away a part of the *Water* with it. This same spirituous, or *elastic Æther*, is also the Cause why the narrow necked Stone or Glass Bottles, that are filled to the Top with the brisk *Mineral Waters* of cold Springs, often burst: Which is a Thing well known to those who have dealt in the *Pymont Waters*. For thus Bottles of very great Strength, and well secured at the Top, have been broke to Pieces; especially when they were set near the Fire, or in a warm Place.

12. We may derive another *Mark of the Waters* ^{excellence} of *Mineral Waters*, from a curious Experiment of the *Air-Pump*. For when a Glass of such *Water*, rich in *Medicinal Virtue*, stands in the *exhausted Receiver*, all the subtile and spirituous Parts of the *Water* immediately rise and bubble up in Clusters to a considerable Height; thus exhibiting a beautiful Appearance: which gives us another Method of trying the Virtues of *Medicinal Waters*, by the Eye; and gaining a certain Proof, not only of their *Subtily*, but also of their *elastic Particles*. For such Liquors as contain a larger Quantity of *Spirit*, which all *volatile, urinous Liquors* do, throw up numerous Bubbles in the *exhausted Receiver*; whilst those which are endowed with little *spirituous Substance* afford but few. Whence 'tis plain, that the *Waters* which bubble violently in *Vacuo*, are of a much more subtile and spirituous Nature than such as bubble but little: For

these Bubbles become visible upon no other Account, than because the Weight of the external *Atmosphere*, which kept them down, is here by the *Air-Pump* taken off; and leaves the *elastic Spirit* at Liberty to expand, fly off, and shew it self.

Observations on the Spirit of Waters.

13. The better to establish and confirm the actual Existence of this *spirituous Part* in *Mineral Waters*, we will here subjoin a few considerable Observations. And (1.) nearly all the *Waters of cold Springs*, especially those of a brisk, pungent Nature, being drank at the Well-head, are allowed to be much more efficacious than when carried to any Distance before they are used. And the Reason hereof is evident: For as the *Waters* are violently shook in the Carriage, and rarified by an internal Commotion, they open an easy Passage for this *subtile, elastic, spirituous Part* to escape and forsake them.

14. (2.) 'Tis also found necessary, exactly to stop down the Bottles, containing these *brisk Mineral Waters*, for Carriage and Exportation; and unless this be done, they lose not only their peculiar Smell and Taste, but all their particular and spirituous Virtue: As plainly appears from the *Pyrmont, Spaw*, and all other *brisk Waters*; which being exposed to the open Air, lose all their Taste, Quickness, spirituous Parts, and Efficacy; grow flat, and leave a thick, dreggy, and exhausted Liquor behind them.

15. (3.) Nor is it sufficient that the *Bottles* be well secured at the Top, unless but little empty Space be also left for the external Air to possess; which would otherwise spoil the whole. For there is nothing in Nature that disturbs and corrupts the Mixture and Texture

ture of *Liquors* more suddenly than the *external atmospherical Air*: As appears plain from the Instance of *Wine*; which when kept in Vessels but half filled, presently grows flat, dead, and musty. Something of the like Kind also happens to *distilled aromatic Oils*; which being exposed to the Air, grow thick, deep coloured, and change their fine Odour to that nauseous one of Turpentine. So pale *volatile urinous Spirits*, likewise, acquire a yellow or red Tincture, if the *Air* comes at them. And in all respects the *Air* has a powerful Influence upon *Liquors*; as being endowed with a brisk Motion, whereby it easily lays hold of, and carries off with it, all the subtile, most moveable and volatile Parts of Fluids; and by its own intestine Motion changes and destroys the Texture of their Parts, whereon their particular Nature, Properties, Taste and Odour depend. And this is remarkably the Case in *Mineral Waters*; to which nothing is so prejudicial as a free Access of the *Air*: insomuch that the most effectual of them, when exposed thereto, become perfectly changed in their Nature; and can afterwards scarce be known for what they were: So inactive, sluggish and indolent are they thereby rendered.

16. (4.) *Medicinal Springs* much sooner lose their Virtue in a hot *Air*, than in a cold one; whence these *Waters* are more advantageously carried from the Spring-head to other Places, by Night, and in a cold Season, than by Day, or in the Heat of Summer. And for the same Reason, they are best drank somewhat early in the Morning, at the Spring-head, than towards Noon: Because the external Heat, by increasing their internal Motion, dissipates their fine and most efficacious Part,

and carries it off into the Air. *Cold*, on the contrary, by contracting and pressing the Water somewhat inwards, rather helps to unite this fine Spirit, and detain and preserve it in the Body of the *Water*.

17. (5.) It is still a more eminent Instance to our Purpose, that not only such *Mineral Waters* as have been long exposed to the free Air, but, in a much greater Degree, those that have once been boiled, entirely lose their *medicinal Virtue, Taste, and Spirit*. And here it requires an attentive Remark, that many *Waters* which turn inky with the Powder of *Galls*, alter not their Colour with the same Powder when their *spirituous Substance* is exhaled, or the *Water* has conceived a Heat at the Fire: Which is an evident Sign, that, together with their Spirit, they lose a certain *volatile Mineral Principle*. Whence it must be noted as an absurd and pernicious Error in those Physicians, who advise their Patients to use the *brisk Mineral Waters of cold Springs*, after being warmed in an open Vessel at the Fire; as by this Procedure the peculiar Virtue expected from them, which entirely depends upon this spirituous Part, is lost; and the *Mineral Water* rendered no more serviceable than *common Water*: For altho' these warmed Mineral Waters may have their Use, yet he will be strangely deceived, who expects more from them in such a State, than from *common warmed Water*. But for those who cannot bear to drink these *Waters* cold, as they cannot who have weak Stomachs, and weak Nerves; the best way of warming them, is, by putting the containing Bottle, close stopped down, into a Vessel of heated Water, so as to prevent the Avolation of the *Spirit*. But the Bottle, tho' strong,
will

will thus be apt to burst, with great Violence, unless a Pin-hole be made in the Cork.

18. (6.) It is farther observable, that all *brisk, and sprightly, cold Mineral Waters*, if mix'd with *Rhenish Wine*, or any other tart Liquor, presently make a considerable Ebullition, especially if *Sugar* be added, and stirred in with the Mixture; which thus exhibits an agreeable sight to the Eye, as throwing up an innumerable Quantity of Bubbles to a considerable height; whilst the white, frothy Head below, discharges a copious Vapour, that may be felt with Pleasure by the Drinker: insomuch that there are many who take a Delight in drinking *Rhenish*, or other small and tart Wine, thus mixed with a brisk *Mineral Water*. And this Experiment has occasioned several to observe, that the better these *Waters* are, the greater Ebullition and Frothing they produce upon mixing with tart *Wine*; and, on the contrary, that those which are weak, sluggish, insipid, exhausted, or any way destitute of Spirit, occasion not the least internal Struggle with the same. This Conflict and Ebullition is entirely owing to the *acid Part* of the *Wine*, mixing with the *subtile Earth of an alkaline Nature*, lodged in the Water: For there is scarce any of these brisk *Mineral Waters* but make an Effervescence upon mixing with a powerful Acid: Which is a plain Demonstration that they contain a certain not *acid*, as has been phantastically imagined, but *alkaline Principle*. And therefore, whilst the *Acid of the Wine* here acts upon the *Alkali*, the *spirituous Parts* of the Water are put into motion; and, as in all similar Cases (which in *Chemistry* are extremely numerous,) endeavour to make their Escape
with

with Violence ; and thus collect into Froth, and breathe out a potent Vapour.

(7.) 'Tis an Observation of considerable moment, that when these *brisk Waters* are bottled, much the most efficacious part, both for promoting or strengthening the Faculties of the Body, and raising an Ebullition with thin, tart *Wines*, lies towards the top of the Bottle or Flask ; far excelling that which remains below : for the *ætherial elastic Principle* of these *Waters*, by reason of its extreme Subtily, Levity and Mobility, ever strives to get uppermost.

19. (8.) Lastly, 'tis no unpleasant Sight to observe, when these *brisk spirituous Waters* are fresh taken up at the Spring-head, in a clear crystal Vial, and shook by the Hand, whilst the Orifice is stopped by the Finger ; they not only froth, when the Finger is taken away ; but the included Air also, and the Water contiguous to the Neck, spirts and flies out with an audible Noise. The reason whereof has been already sufficiently explained ; as being owing to nothing else but the Agitation, and Motion of the very *elastic* or *ætherial Principle* we are speaking of.

Efficacy of
the Spirit
of Wa-
ters.

20. And thus, by an *Induction of particular Experiments and Observations*, we think it plainly appears, that the *brisk Medicinal Waters* contain a certain *very subtile, active and elastic Principle* ; to which the several Phænomena and Effects above related, are entirely owing. And this *Principle* we take for their most curious and effectual Part, or as it were the *Soul*, that gives them their surprizing Virtues of curing numerous, stubborn and obstinate Distempers. This noble, *native Spirit* it is, which, by its penetrating Nature and admirable

mirable Faculty, renders itself perceptible to the Smell and the Sense ; not only affording a grateful Odour in its Exhalation, but also filling the whole Head therewith : so as sometimes to render it heavy, by receiving the Vapour of the Spring ; and make those who drink the *Water* sleepy. The same *spirituous Principle* is also of such an *elastic, expansive, and volatile Nature*, as to insinuate into the finest Branches of the Arteries in the Head ; and so far to rarify the Blood, as to make it sometimes even oppress the Brain, and retard the Circulation : whence it is found by Experience, particularly of the *Pyrmont Waters*, which are the strongest or most spirituous of all in *Germany*, that they cannot, in a hot and dry Season, be directly drank at the Spring-head ; but require, for that Purpose, to be carried to some distance, for the Patients to drink at their Lodgings. For thus, by the Time and Motion of the Journey, the *subtile Spirit*, that would otherwise oppress the Head, gradually exhales and goes off into the Air.

21. This *Mineral Spirit* is likewise the Reason that the *Waters* endowed with it, do not cool and weaken the Body ; but rather heat and strengthen it : so as in some short time after drinking, to increase the Appetite, raise and quicken the Pulse, and give a rosy Colour to the Face. The same *subtile Spirit* is also the Principle of their extraordinary Power and Efficacy ; whilst it nimbly passes thro' the whole Body, and by its Subtilty, Agility, and Expansion, strongly endeavours to reach and stretch to the Extremities of the Vessels ; adding Strength in its Course to the moving Fibres, exciting them to Motion, opening the Obstructions in its Way, throwing off what is

•noxious

noxious and superfluous, by all the Outlets ; as by Stool, Urine, Sweat, and sometimes by Vomit, according to the present Disposition of the Body, or Nature of the Distemper. And lastly, this *noble Principle* it is, which when exhausted or deficient, proves the Decay and Destruction of *Mineral Waters* ; whence some *Springs* of late Date, being greatly frequented at their first Discovery, as productive of surprizing Effects, and curing Diseases that had been found incurable by other means, have soon after lost their Reputation : and for want of this presiding generous Spirit, sunk to the Condition of *common Water*, and work'd no more such Wonders. Thus we have Instances of a few *Springs*, which at their first Discovery, have perfectly cured the *Gutta Serena*, *Deafness*, *Lameness*, the *dead Palsy*, *Falling-Sickness*, &c. which extraordinary Virtue has not been lasting ; but in a small compass of time dwindled and expired. So that the Springs in such high Repute, afterwards became perfectly useless, in those very Distempers they had before so happily cured *.

22. As an *Experimental Illustration* of this Account, we will here subjoin a Set of *Observations and Experiments* made upon the *Pymont Waters* ; which, more than any others we have tried, abound in this fine, *elastic, mineral Principle*. And, (1.) the *hydrostatical Instrument* we commonly use for determining the specific Gravities of Fluids, being plunged into a Parcel of this *Water*, newly taken from the Spring-head, it stood at six Points ; whereas in common Water it stands at four. (2.) With powdered

* In order to supply this natural Decay of Springs, see the Attempts for making *Mineral Waters* by Art. SECT. VII.

powdered *Galls* it turns almost of an inky Blackness. (3.) Upon dropping in *Spirit of Vitriol*, there arose a violent Conflict. (4.) Upon the Addition of *Syrup of Violets*, there appeared a green Tincture. (5.) To the Taste this *Water* was pungent, sharp, and somewhat vitriolic. (6.) Upon shaking the containing Vessel, the *Water* affords an innumerable Parcel of Bubbles. (7.) Being drank in a sufficient Quantity, these *Waters* purge a little, pass off presently by Urine, and restore a lost Appetite. But if this *Pyrmont Water* be poured into a large Bason, and suffered to stand for twenty-four Hours, exposed to the temperate and open Heat of the Air, the following Phænomena ensue. (1.) The specific Gravity alters, and the *hydrostatical Instrument* sinks to four Points; which manifestly shews, these *Waters* have now the same specific Gravity with *common Water*. (2.) They no longer turn in the least black with *Galls*. Nor (3.) make any Conflict with *Spirit of Vitriol*. (4.) They no longer turn *Syrup of Violets* green. (5.) They have now lost all their particular Taste, Odour, and Pungency. (6.) If drank, they now oppress the Stomach, fill and distend the Intestines with Wind, and pass off slowly. (7.) Their pleasing Transparency is lost, and the *Water* becomes thick and muddy, with a Skin of various Colours on the Surface; and a chalky, and irony Sediment falling to the bottom. So sudden is the Catastrophe of these strong *Medicinal Waters*; which thus, from being possessed of excellent Virtues, run into a flat, dead, useless Water, of no medicinal Virtue; barely for want of the *spirituous Substance*, wherewith it was before so plentifully endowed: As manifestly appears not only to *Reason*, but also to the *Senses* themselves.

23. After

Origin of
the Spirit
in Wa-
ters.

23. After having said thus much of this fine *Mineral Spirit*, Mens Curiosity will doubtless be raised to ask the particular Nature and Disposition of the Thing, whereof we relate such wonderful Virtues and Effects. To satisfy them all we can, we must come to a *chemical Consideration* of the Subject; and wish the Generality so well instructed in that Art, as to understand our Meaning: For we have not the least Intention to amuse Mankind, or in any respect force a false Notion upon them. Real *Facts* and *Experiments* are what they must be guided by; and if our Notions and Theory are not built upon these, we desire they may not stand. Our Opinion therefore is, that this extremely moveable, subtile, and elastic *Principle*, is a Portion of the *universal Spirit*, the Fountain and Cause of all the particular *Spirits* in other Things, whether of the *vegetable, animal, or mineral Kingdom*. But as this *Spirit* seems to have a principal Seat, and chiefly to exercise its Power in what we, in a chemical Sense, term *Sulphur*, or purely oily and inflammable Matter; and as this *Sulphur* is of three Kinds, according to the three Kingdoms, animal, vegetable, and mineral; this *universal Spirit* coming to be differently modified, altered or changed, according to the different *Sulphur* wherein 'tis lodged, thus assumes a different Nature, and becomes productive of different Effects. By *Mineral Spirit*, we therefore understand an *exceedingly rarified, fluid, elastic and volatile Substance*, blended in amongst, and combined with all the *sulphureous Parts of Minerals*; and pervading all the lower Regions of the *Earth*: So as to become the *animating Principle of Minerals*, and the true Cause and Origin of the

the various Changes and Effects which happen in the Bowels of the *Earth*: Whence 'tis up and down found amongst mineral Bodies, under the Form of a *penetrating sulphureous Vapour*; and becomes the certain Sign and Evidence of *Mines*, or an *Earth* productive of *Metals*. And this *Spirit* coming in the way of *Waters*, as they flow along the Entrails of the *terrestrial Globe*, is catched up by them in their Passage, and thus impregnates them with their *Medicinal Virtue**.

24. Thus, at least, the Matter appears to our selves: Tho' we are not singular in this Opinion; but have the concurrent Testimony of some very eminent Men, who have made the Search of Nature their Study. The Author we most rely upon, in this Particular, is that great *chemical Philosopher*, *Becher*; who judges that *Mineral Waters* do not proceed from hence, that certain concentered Juices of the *Earth* are dissolved by the *Waters* running over them: because if that were the Case, the subterraneous Parts abounding therewith, tho' almost ever so large, and well furnished with the *Mineral Matter*, would, by the continual Flux of these *Waters*, be washed away; but rather, to speak in his own chemical Language;

* This Doctrine will receive greater Evidence and Confirmation in the Course of the Work; and seems farther countenanced by the Experiments and Observations of *Dr. Lister*, *Mr. Boyle*, and other eminent Naturalists and Chemists. Particularly, certain *Air-Pump Experiments*, and the artificial Generation of *Mineral Waters*, by means of the *universal sulphureous Acid*, and *alkaline Earth*, appear to strengthen it *a Posteriori*. See SECT. VII. But the *Philosophical Doctrine* of *Mineral Waters* is not the present Subject; any farther than it relates to a Discovery of the *Natures*, *Virtues*, and *Uses* of these *Waters*.

guage ; that “ They consist of a *central Acid*
 “ *of the Earth*, which is permanent, inexhausti-
 “ ble and mixed with but an extremely
 “ small Proportion of a *Mineral Substance* :
 “ for certainly the Virtue and Efficacy of such
 “ *Waters* are, in no wise, owing to their gross
 “ *Mineral Contents* ; but rather to their pro-
 “ digiously *elastic, volatile and spirituous Prin-*
 “ *ciple* *.

Whether
 Mineral
 Springs
 are imita-
 ble by Art.

25. The delicate Nature of this *Spirit* is the true and principal Cause of the great Difficulty, even by the utmost Address of Art, of preparing *Waters*, in a chemical Way, that shall perfectly resemble, and have the noble Virtues of the *natural hot, or cold Medicinal Springs*. For if the Case were otherwise, and their Virtues owing to a Solution of any solid or saline *Mineral Substance*, it would be no Difficulty to dissolve the Matter that remains after Evaporation of the *native Waters*, or something of the same Kind, in *common Water* ; so as to imitate them in their *Virtues*. The only Reason of Failure in this Particular, seems owing to a want of knowing how to introduce this *curious subtle Spirit* †.

26. And

* See Becher. *Physic. Subterranean*. SECT. II. CAP. 4.

† That Bodies may be regenerated, or recomposed, appears from several Instances, particularly *Nitre*, common Salt, and Brimstone, from their acid Spirits ; Quicksilver from Cinnabar ; Iron and Copper from Vitriol, &c. Could not therefore a way be found, after the chemical Analysis of a *Mineral Water*, to combine its several Principles together again, in their natural Order and Arrangement ; as it is no difficult Matter to do, after such a chemical Analysis of *Wine*, by introducing a *Frost* ; or at most a Fermentation : which entirely restores the natural, vinous Texture, as more Persons than one have experienced ?

26. And this Consideration suggests a *Question* of considerable moment ; viz. Whether this most *efficacious Principle of Mineral Waters* cannot by Art, or some chemical Contrivance, be separated, obtain'd pure, and concentrated, or reduced to an admirable Medicine? For my own part, I conceive it a thing of great difficulty ; yet have no room to question, that if a considerable quantity of such a *spirituous Water* were taken from the Spring, and immediately put into a large distilling Vessel, the Junctures whereof were exactly closed, and a very gentle Heat directly applied, a Spirit, of great medicinal Virtues, might be procured : which is an Experiment that we earnestly recommend to the Trial and Diligence of the Skilful and Curious in Chemistry*.

II. Of

It seems no unnatural Supposition, that all *Mineral Waters*, especially those abounding with a *copious Spirit*, are in a kind of *Fermentative State* ; which always gives a Briskness, and ceases when the Spirit flies off : and that this *Spirit*, or something like it, may be introduced by Art, will appear when we come to consider the chemical ways of imitating *Mineral Waters*. Attempts of this kind have been much discouraged by the *general Opinion*, that the Fire so alters the Texture and Arrangement of the Parts of the Bodies, that they can by no means be re-instated. But there are many Instances to the contrary, in Solids, and some in Fluids ; especially where the Analysis was gentle, and conducted by the Rules of Art. A proper *Intermedium* seems the only thing wanted ; which for re-instating *Wines* is any rightly disposed *fermentable Matter* ; and for *brisk Medicinal Waters*, perhaps a proper *Alkali* and *Acid*, in the requisite Proportion.

* By many exact Experiments, hitherto unsuccessfully made with this View, it appears that not the least Quantity of such a *Mineral Spirit* can be obtain'd, or rendered sensible and permanent. Whence it should seem that such a *Spirit* is not a corporeal thing, but

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rather

II.

Of the AQUEOUS PART in WATERS.

The Nature and Virtues of pure Simple Water.

27. We proceed to the second *Ingredient* of *Mineral Waters*; which, to distinguish it from the rest, we call Pure or *Elementary Water*. This, in its Quantity, exceeds both the others; and is the common Receptacle as well of their *spirituous* as *earthy* and *saline* Principles. Yet as near as this *aqueous part* may approach to *common Water*, it is not destitute of considerable *medicinal Virtues*; for by its Moisture, Thinness, or Degree of Rarification, 'tis wonderfully serviceable both in preserving and restoring the Health of the Body. It washes all the Juices, dissolves down thick and viscid Humours, drinks up all the morbidic Salts in its Passage, and coming into the innermost Cells of the *Viscera*, there wears away Coagulations, or the obstructing Matter, and discharges it, along with the other droffy Parts, by the proper *excretory Ducts*. And as this, we are well assured, from *Experiment* and *Observation* compared

rather depends upon a temporary Conflict of the natural *Acid* and *Alkali* contained in the *Waters*; as was intimated in the Note above: and will be made more probable in the seventh *Section*; upon the *artificial Imitation* of the natural *medicinal Springs*. However, the unsuccessful Experiments mentioned by the *Sieur du Clos*, as made before the Royal Academy of Sciences at *Paris*, are not sufficient to discourage any farther Attempts for procuring this *Spirit*: for thro' the whole Course of those Experiments, there appears a great want of the chemical Skill and Accuracy, so requisite to a thorough Examination of this Subject.

pared with the natural Structure of the Body, is actually the Case ; it will be a thing of very considerable Use, attentively to consider the *Nature, Properties and Virtues* of pure *Simple Water* ; without any Mixture of the fine *elastic Spirit*, or any saline or mineral Ingredient. For 'tis most certain, that according to the Difference of the Places and the Soil where Springs rise, they differ extremely from one another : So that one *Spring* shall be much wholesomer, and fitter for various Uses than another.

28. In the *first* place therefore, it is a com-
 mon Observation, familiar in the *Kitchen* and *Snow-Water.*
Laundry, that some *Waters* are hard, crude and rough ; and others again soft, mild, smooth, or as it were milky : The former whereof are properly accounted bad, and the latter good. Among the *crude* and *hard Waters*, we reckon that which is obtain'd by the dissolving of *Ice* : And of this *Water Hippocrates* says very justly *, “ That the clear, light and sweet part “ in frozen *Water* is dissipated and dis- “ charged ; and only the turbid and ponde- “ rous part left behind : For, if a certain mea- “ sured Quantity be set to freeze in the open “ Air, and the *Ice* be the next Day dissolved, “ in a warm Place, and the *Water* be now “ measured again, it will be found to have “ lost much of its Quantity.” The same Au-
 thor likewise assigns a very good Reason why *Snow-Water* is rather pernicious than advantageous to Vegetables and Animals ; as *Water* by freezing has its Texture destroyed. For 'tis manifest, that the *subtile Principle* of the *Water* is thereby separated from the gross Part, and driven towards the Centre :

D 2

Whence,

* *De Aere, Aquis & Loc.* §. 20.

Whence, in the middle of all *Ice*, there appear large Bubbles, proceeding from the subtil, elastic Matter being driven inwards; where, by its rarifactive Motion, it increases the Bulk of the *Ice*, and causes it to possess a greater Space, than when in the Form of Water: And thus occasions the bursting of such glass or earthen Vessels as it happens to be contained in. And this shews by what means the fine, *fluid, elastic Principle* is separated, and only the grosser and more ponderous Part left behind: Insomuch that *Water* being despoiled and corrupted by this Operation, must needs become unwholesome. But principally the Use of *Snow-Water* is found to produce Swellings in the Glands of the Throat; as frequently happens to those who inhabit the Bottoms of Mountains, that are all the Year covered with Snow; but especially to the Women, who have generally large Tumors hanging at their Throat. And this the People who live at the Foot of the *Alps, Pyreneans, &c.* to their great Misfortune, experience. Those *Waters* therefore must be carefully avoided, which upon a general Thaw, flow down the sides of the Mountains into the Vallies; and thus often pollute and corrupt the *Springs* and *Rivers*.

The Waters of Mines.

29. In the next place, those *Waters* prove hard, crude and unwholesome, which are found in *metallic Mines*; or descend from very *high Rocks*: because they lick up in their Passage many rough, earthy, and astringent Particles from the Fossils, Minerals, Chalk-stones, and the harder compacted Bodies they run over; and thus become impregnated therewith: whence few can bear to drink them. And their Use, to such as are not accustomed thereto, proves very pernicious. Thus 'tis observed

served by *Hippocrates**, that those *Waters* are to be rejected as unwholesome which flow from *Rocks*; for this renders them hard: And those again which run near to *hot Springs*, Beds of *Iron-stone*, *Sulphur*, *Alum*, &c. for none but crude, heating and unwholesome *Waters*, that pass not well by *Urine*, but bind up the *Belly*, are to be found in such *Places*. And we cannot but commend the *Justness* of the *Observation*, with regard to the *common Waters* found near *hot Springs*: for such generally prove crude and unwholesome, unfit for *Brewing*, or promoting the *Secretions* of the *Body*; but rather obstruct and hinder them. And the reason hereof seems chiefly owing to the chalky, rough, *styptic Earth*, with which the *Soil* about these *Springs* most commonly abounds.

30. Again, those *Waters* are crude, heavy, Chalky, and sluggish, which spring up in chalky Ground†; and Stony Waters. as may appear from the *Pipes* or *Canals* thro' which they run: for they all along deposite an earthy, chalky Matter, that lines the inside of these *Conduits*; and when boil'd over the *Fire*, strike a stony Crust to the *Sides* of the *Vessel*. In short, the *stony Waters* of all kinds, running upon chalky *Beds*, are unwholesome, crude and hard; as the Matter of these *Beds* is easily imbibed by the *Waters*, and renders them gross and heavy: so that when drank they pass with difficulty thro' the fine *Canals* of the *Body*; nor readily reach the *Extremities* of the *Veins*, without causing *Obstructions*.

31. Lastly, those *Waters* are unwholesome which Stagnant collect themselves in *stagnant Ponds*, *marshy Waters*, *Grounds*, or are received into *Reservoirs*, form'd on purpose to preserve the *Rain* that runs from

D 3

the

* *De Aere, Aquis, & Loc.* §. 13.† *Ibid.* §. 17.

the Tops of Houses; as also those of *Springs*, arising in an open champain Country, and having a muddy, unctuous, earthy, or bituminous Bottom; for all these are gross, turbid, and somewhat fetid: and tho' frequently refresh'd by new *Rain*, lose their fine, thin and most useful Principle, by the Sun's beating continually upon them: whence they become apt to cause *Obstructions* in the finer Vessels, and productive of *chronical Distempers*.

Rain
Water.

32. On the other hand, those *Waters* must be allow'd good and wholesome which are light, sweet, soft, thin, and readily pass thro' all the excretory Vessels of the Body. And of this kind, in the first place, are certainly those raised by the *Sun* into the *Atmosphere*. The Cause of this is, with more chemical Knowledge than one could expect, delivered by *Hippocrates*, in these Words, "*Because the Sun raises that part which is thinnest and lightest; leaving behind what is saline, gross and heavy, in the Sea.*" For in reality, *Rain Water* is *Water distilled by the Sun*; which not only raises from the *Ocean*, but likewise from all *Springs* and *Rivers*, the lightest and thinnest parts of the *Waters*, makes them mount into the *Atmosphere*, attenuates, perfects and digests them with its Rays; and indeed enriches them with the *universal, ætherial, and sulphureous Salt*, or rarified and exalted *Nitre*; as appears from *Experiment* and *Observation*. So that by this means, the chemic Sun seems to prepare a most perfectly pure and wholesome *Water*, which will readily pass thro' all the finest Vessels of the Body, wash the capillary Meanders thereof, and promote its own Discharge by the Law of Circulation. Whence this *naturally distilled Water* is better fitted than any other for the
Nutrition

Nutrition of Vegetables, the *brewing of Drinks*, the *infusing of Herbs*, all Family Uses; and is of itself, without farther Preparation, one of the *noblest*, and when properly used, perhaps the most *Universal Remedy* in all *Nature*: as we propose more fully to shew hereafter *.

33. We are sensible of the *Objections* against this general Position, as to the Purity and Perfection of *Rain Water*. 'Tis said that "this *Water* soon putrefies, corrupts and stinks; " and thence must necessarily become unwholesome." But to consider the Matter chemically and closely; tho' the Fact here alledged were certain; yet it only demonstrates, that this *Water* abounds with *sulphureous Particles*; which is also confirmed by numerous chemical and philosophical Experiments. But this Inconvenience attending *Rain Water* may in great measure be prevented, by catching it, not after it has washed the Tops of Houses, and run thro' foul Pipes and Conduits, but as it falls immediately from the Air, in an open place where no Houses stand. For thus, when it has stood a while to settle, cleanse and purge itself, as it will in a very few Days; it may be drawn fine from its Bottom, and long preserved perfect, in pure Vessels of Earth or Glass. But if put into Vessels of Wood, especially such as are new, it thence extracts numerous, fermentable, sulphureous Parts; and accordingly runs into what is commonly called Corruption. And the reason of this Difference is plain from chemical Experiments; for as by standing, the gross *Sediment* falls to the Bottom, that, like the Lees of Wine or Beer, contains the subtile, fermentable, sulphureous Particles, which have the Power to begin or renew an

D 4

intestine,

* See SECT. VI.

intestine, fermentative or corruptive Motion; when these busy Particles are once separated, whether by standing, Filtration, or Distillation, the pure remaining Fluid must needs remain unaltered in its natural Texture and Constitution.

34. 'Tis also worth observing, that the *Rains* which fall about the *Vernal Equinox*, and in the Month of *May*, when the *East* and *South* Winds blow, are of a much more subtle and spirituous Nature; or refresh and nourish all the vegetable Kingdom, better and quicker than those that fall in other Months, when the Winds stand to different Points of the Compass. The reason whereof seems owing to this, that in the coldest Countries, or such as are filled with dense Vapours, the *Exhalations* of the *Earth* and *Waters* cannot be so much ripen'd and refined, as in Countries where a warmer Sun raises them up, concocts and brings them to Maturity.

Spring
Waters.

35. The next Degree of Perfection we assign to those *Waters* where the *Springs* lie high, rise in clean earthy Hills, and run upon a gravelly Bottom, or pure hard Clay; provided they be *sweet*, that is, perfectly tasteless, limpid, transparent, cold in the Summer, warm in the Winter, and receive the Rising-Sun. For when *Waters* pass thro' such a kind of porous, spongy *Earth*, which is not dissolved thereby; they are thus percolated, filtered and purified, after the manner of that common Practice in *Italy*, *Sicily*, *Holland*, and other Countries, where they pass their thick and muddy *Waters* thro' a certain spongy Stone, cut and chizzel'd into a kind of *Mortar*; so as to become a large and proper *Filtre*, for thoroughly purifying the *Water*,
which

which it transmits perfectly bright, clear and grateful ; retaining the Filth and Slime behind.

35. There are certain œconomical Observations, and ways of proving the Goodness, Excellence, Thinness and Virtues of *Waters*. It is a thing known to every one, that those *Waters* are soft and light which readily take Soap, easily wash Linen, and quickly boil Pease, Pulse, &c. soft and tender : and the *Waters* which will not do this are properly accounted rough, harsh and hard. But for these Purposes there is nothing comparable to *Rain Water* ; which is admirably fitted for the washing of Linen, and boiling of Pulse, Herbs, &c. to the greatest Perfection. So likewise those *Waters* are to be esteemed good and excellent, which best serve the Purposes of *Brewing*, or the making of *Malt Drinks* ; for 'tis certain that the Wholesomeness of *Malt Liquors* has a great Dependence upon the Goodness of the *Waters* : whence such Countries always brew the best, wholesomest and soundest Drinks, as are supplied with the best and purest *Waters*. In general, hard *Waters* make the best Beer for keeping, and soft *Water* the best for Flavour, but apt to turn sour. And a proof of Excellence in this Case, is when the Drink neither oppresses the Stomach, nor binds up the Belly ; but passes readily by Urine. On the other hand, in those Countries where the *Waters* are thick, gross and slimy, the Drinks are unwholesome, generate Wind in the Stomach and Bowels, pass sluggishly thro' the Canals of the Body, breed Stones and stony Matters in the *Viscera*, rot the Teeth, relax the Gums, &c. of all which there are but too many Instances in particular Countries. Another Sign of Good-

To try the Goodness of Waters.

Goodness in *Waters* may be taken from their feeding and producing fine wholesome Fish ; and their indisposition to freeze. For these Particulars prove a Fineness of Parts, and a temperate and wholesome Nature in such *Waters*.

*River
Water.*

36. Those *Waters*, likewise, that remain long sound and uncorrupted, may be esteemed good ; as this affords some Token of their being free from Impurities, and Parts that do not properly belong to them ; but rather simple, pure and full of the *spirituous Principle* ; which preserves them from Corruption. And hence 'tis found, that if *River Water*, as well as *Rain Water*, be first freed from its Filth by standing, drawing off from its Bottom, or filtering thro' a porous *Stone* ; and then put into proper large Earthen Vessels, and preserved in a cool Vault or Cellar ; it keeps much better and longer than when committed to little Vessels, and set in a warm Place. And thus the *Water* of the *River Tiber*, which the common People drink thick and muddy as it runs, is clarified and preserved by the Nobility of *Rome*, in large *Earthen Vases*, that stand in their *Wine Cellars*. Whence it remains perfect and uncorrupted for many Months ; or even for Years.

*Chemical
Signs of
good Wa-
ter.*

37. Besides the several *Signs* of the Excellence of *Waters*, above deliver'd, there are abundance more, derivable from the Art of *Chemistry* : tho' these being not so well suited for general Use, we shall not enter into a Detail of them ; but finish this Account with observing, that soft, subtile *Waters*, and particularly those of *Rain*, are constantly found the fittest for washing what we call the *Calces* of *Metals*, from their Salts : whilst hard *Spring Water*

Water is very unsuitable for this Purpose. And what is still more obvious, and may be tried by every one, the making of *Spaud*, or artificial Plaister of *Paris* from calcin'd *Alabaster*, does not succeed with *Rain*, or other thin soft *Water*; but in order to bring the calcin'd Powder to a stony Hardness, a rough *Spring Water* is required. *

III.

OF THE SOLID PARTS IN WATERS.

38. Thus far we have examined, with all the Clearness we could, two of the Principles of Mineral Waters; viz. The *spirituous* and the *aqueous*: we next proceed to the third, which is their *solid Part*. And this we find to be of different Kinds; and greatly contributing to the *Medicinal Virtues* of the *Waters*. For both *Natural Philosophy* in the general, and our own numerous *Observations* and *Experiments* in particular, clearly demonstrate and exhibit to the Eye, that *Mineral Waters* not only abound with *Salts*, but likewise with *Earths* of different Kinds. In discovering these various Kinds of solid Substances, *Physicians* and *Naturalists* have been greatly deficient; and delivered us very little of Use, upon so important a Subject. Nor indeed could any thing better be expected from them, whilst they have generally remained grossly ignorant in *Philosophical* and *Chemical Experiments*; whence they have transcribed from one

The Salts
and
Earths in
Waters.

* See the Affair of pure common *Water* discussed under SECT. V. where *Water* is considered as an universal Remedy. See also SECT. IV. which shews the Origin of the several *Waters* of the Globe.

one another the more loose, popular Opinions, and flying Rumours upon this Head; without diving into, and solidly examining Matters of Fact. We shall here therefore attempt to supply this general Defect; and deliver a *Set* of true and certain *Marks, Signs, or Characteristicks*, of the precise Nature of whatever Salt, Mineral, or Metalline Matter is actually contained, and how they may be rendered sensible, in *Mineral Waters*.

No real
Metals in
Waters.

39. Before we proceed to the Business itself, we must here note and reject that common imaginary Notion, as to the Existence of *Gold, Silver, Lead, Tin, Antimony, &c.* in these *Waters*. For 'tis certain, and abundantly confirmed by *chemical Experiments*, that no Metals are soluble, or can possibly enter the Composition of *Waters*, unless the Metal be first dissolved, or turned to a *Salt* or *Vitriol*: but in Fact, there is no such thing to be found in the Bowels of the *Earth*, as the *Vitriol of Gold, Silver, Lead, Tin, Antimony, Arsenick*; and consequently these Metals and Minerals can never possibly come into the *Waters*, nor be exhibited to the Eye, as a part of their *Contents*. *

40. Ano-

* What the Generality of Authors upon *Mineral Waters* pretend of their containing *Alum, Sulphur, Vitriol*, and numerous other fictitious Matters, is by Dr. Lister shewn owing to the *Pyrites, sulphureous Marcasites*, or *Vitriol Stone*, so plentifully lodged in the *Earth*, and dissolvable by the *Waters* in their Passage. An exact Enquiry into the Origin, Natures, and Properties, of these *Stones*, is therefore preparatory to a *Philosophical Account of Mineral Waters*. Put this Enquiry belongs to a *second Treatise* upon the Subject; which we hereafter propose. See Dr. Lister on the *Medicinal Springs of England*; especially the ninth and twelfth Chapters of his first *Exercitatio*; where the Foundation of the Thing is laid.

40. Another Error of the same Kind has *No Nitre* arisen from the Inattention and Fondness of *in Water*. certain *chemical Writers*; who are swayed more by *Notions* and *Theories*, than by *Facts* and *Experiments*; and would thus persuade us that *Mineral Waters* are impregnated with a true, material, and *inflammable Nitre*. The Foundation of the Error lies here, that true *Nitre* is not, as they imagine it, a fossil, or mineral *Salt*; nor ever dug up in the *Earth*; but strictly and properly belongs to the *Vegetable Kingdom*, and the whole Mass of the *Atmosphere*; whence it comes to be deposited and lodged in a fat *alkaline Earth*, as a proper Receptacle: insomuch that we are not satisfied, by any *Experiments* of our own, or others, that true *Nitre* is obtainable from, or can be shewn to exist in *Mineral Waters*; at least not so much as it does in the *Air* it self: from whence it may by several *Artifices* be extracted; as particularly by exposing *Quick-lime*, *Pot-ash*, or any *fixed, alkaline Salt* or *Earth* to the *Air*, in a place well shaded and defended from the *Sun* and *Rain*. *

41. With no less Absurdity some have pre- *No Sal-*
tended, that *Sal-Ammoniac* abounds in *Mineral* *Ammo-*
Waters; *niac in*
Waters.

* According to the Account of the *Sieur du Clos*, there are numerous *cold Springs* in *France* that contain what he calls a *true Nitre*; as particularly those of *Pougues*, *St. Mion*, *Pont-Gibault*, &c. But he must surely mean by *true Nitre*, either the *Nitre of the Antients*, or the *calcarious Nitre* of *Dr. Lister*. The *Nitre* of the *Antients* was a *lixivious alkaline Salt*; and somewhat like it is found in *Mineral Waters*. But the *calcarious Nitre* of *Dr. Lister* is *uninflammable*; and no way truly *nitrous*. Or if any *Spring* shall appear to contain a real *Nitre*, that is, *Salt-petre*; let it be carefully examined if this be not *accidental*, and properly owing to a *vegetable Cause*: for *Salt-petre* has no *Mine*.

Waters; whereas 'tis well known that this Salt is an artificial Production from a Mixture of a *volatile, urinous Salt, Soot, and the Acid of Sea-Salt*. And tho' the natural Existence of this Salt in *Waters* is argued for, from the *Sal-Ammoniac of the Antients*, and the Salt thrown up by *burning Mountains*, such as that of *Vesuvius*, &c; yet whoever diligently enquires into these Matters, will find the ancient *Sal-Ammoniac* was produced from the Urine of Horses, Camels, and other Creatures, discharged upon the Earth, and separated from its more aqueous Part, which strained away thro' the Sand, leaving a concreted Salt behind; and that the pretended *Sal-Ammoniac* of burning Mountains is but a *sulphureous, saline Substance*, and not what we properly and strictly call by the Name of *Sal-Ammoniac*: tho' 'tis true it contains a *volatile Spirit*. *

Fixed
Salt in
Mineral
Waters.

42. A third Error has been pretty generally maintained, upon the apparent footing of Experiment and Observation, viz. that there is naturally no such thing as *fixed Alkali* in all the Region of *Fossils*, or the entire *Mineral Kingdom*; but that this could only be obtained from Vegetables, by burning them to Ashes. But the contrary of this Assertion is evident to a Demonstration; and rendered obvious to the Senses: for there is no *hot or cold Medicinal Spring*, of all the large Number we have examined, but affords, by a chemical Process, a *pure fixed Alkali*, in all respects like
to

* The Pretensions that *Sal-Ammoniac* is contained in *Mineral Waters*, rest upon slight Foundations; and seem to proceed directly from Unskillfulness in *Chemistry*. See *Histoire de l'Academ. An. 1713. p. 29, 30.*

to *Salt of Tartar*. And this is the more remarkable, because we know of no *Spring* in *Europe*, even among those which upon account of their Briskness, Spirituosity, Pungency, or a kind of Tartness, have obtained the Name of *Acidulæ*, that contain any pure Acid at all, but every one of them a Quantity of *fixed Alkali*: whence, agreeably to their own Nature, they should rather have been called *Alkalinae*. * And so much for the more prevalent *Errors* as to the Principles, of a fixed and solid Nature, attributed to *Mineral Waters*. We next proceed to examine what *solid Matters* they really contain.

43. We begin with *Metals*; among all the *Irony* Tribe whereof, with regard to Utility and Benefit, *Iron* stands in the first Place: the *Vein* or *Ore* of this being the largest and most extensive of all others. For all the *red Clays* in *England*, *Italy*, *Germany*, and elsewhere, are but a kind of *Iron Ore*; which is otherwise so very abundant, that 'tis hard to find any Part of the Earth wherein some *irony Particles* are not contained. Again, of all the *Metals* there is none that dissolves so readily in all kinds of Acids, as *Iron*. And thus pure *Water* it self, on account of the *ætherial Principle*, and the *universal Salt* it lodges, will soon prey upon and dissolve this *Metal*. So that if a Piece of *red hot Iron* be quenched in common *Water*, it communicates some Particles of it self there-
to;

* The Existence of an actual fixed alkaline Salt in *Mineral Waters*, is now confirmed by many Experiments made in different Countries. See, for Instance, *Histoire de l'Academ.* An. 1699, 1701, 1702, 1708, &c. See also *Urban. Hierne Acta & Tentamina Chymica.* Ed. *Holmæ.* An. 1712. p. 71, 72, 137, 138.

to ; as appears by the strengthening, binding, rough and styptic Taste of the *Water* thus heated. And as 'tis a familiar Observation, that the Moisture of the *Air*, *Rain*, &c. corrodes *Iron*, turns it to rust, and impregnates it self therewith ; there is no Question but that all *Springs* which wash the *Beds of Iron Ore*, or take their Course thro' red, clay Grounds, lick up, in their Passage, Particles of an irony Nature ; and come impregnated with them to the *Spring-head*. And accordingly the *Waters* of such Springs, all over *Europe*, are called by the Name of *chalybeate*, *steel* or *irony Waters*.

*The Proofs
of irony
Matter in
Waters.*

44. The external Signs of these *chalybeate Waters* are derivable from the astringent, styptic Taste, which they in some degree impress upon the Tongue ; and the yellow kind of *Oker* wherewith the Canals or Conduits they pass thro' are lined ; as also the Basons or Reservoirs that contain them ; and the Parts about the Spring-head, where they overflow or are spilt. For if this kind of *Oker*, or rubiginous Matter, be collected, washed, dried, and thoroughly roasted over a strong Fire ; it not only appears of an *irony Nature*, by readily answering to the *Load-stone* ; but affords a no less certain chemical Mark of its being *Iron*, by subliming with *Sal-Ammoniac*, into Flowers, that afford a most bright and perfect *Tincture of Iron*. Other concurring Marks of their *chalybeate* Nature are likewise afforded by the *purple Colour*, or *inky Blackness* they make with powdered *Galls*, the yellow Colour wherewith they stain an Egg put into the *Spring*, and the *Iron-mould* they cause on *Linen* : which are all certain *Characteristicks* of a fine
irony

irony Rust, or the real and material Existence of *Iron* in the *Waters* *.

45. There are some *Mineral Waters* likewise that afford manifest Indications of *Copper*; tho' not in its true *metalline State*, but as dissolved and formed into *Vitriol*. This is eminently confirmed by Experiments made on many Springs in *Hungary*, particularly those at *Newsohl*; wherein if *Iron* be suffered to lye, it comes out a pure and perfect *Copper* †. But the *Waters* of this Kind are of no proper, specific, internal, medicinal Use, by reason of the corrosive and vomitive Virtue which *Copper* ever retains; tho' they may still be serviceable in some particular Cases, by way of *Lotion* or external Application. And besides these two *Metals*, no other that we know of, can by any just Experiment, Observation or Effect, be discovered and rendered sensible, or the least Marks of them traced in *Mineral Waters*. And as the Medicinal Virtue of *Iron* is extremely great, the *Waters* that contain it are to be accounted the most wholesome and efficacious: Whence we cannot but observe the Wisdom and Goodness of the *Creator*, who has so largely supplied all Countries with them. So much for the metal-

The Proof
of copper-
ry Matter
in Wa-
ters.

* Those unacquainted with *Experiments* of this Kind, and their Validity for proving the Truth of Things, may take it for granted that the Trials here produced as *Proofs*, are, in general, simple, well chose, and demonstrative.

† The Truth of this Fact has been much disputed by several Philosophers of *England*, and in general by such as are no Favourers to the Doctrine of *Transmutation*. Those who desire further Information in this Point may consult *Agricola de Re Metallica*, and several other *German Writers*.

MEDICAL
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 The Presence
 of a fine
 Vitriol in
 Water

line Contents of *Mineral Waters* : We now proceed to their *saline Ingredients* ; which their aqueous Part wonderfully fits them to dissolve.

46. The principal *Ingredient* of this Kind is the *Pyrites*, or *Vitriol-Stone* ; which of all others most plentifully and universally abounds in the Bowels of the Earth : there being scarce a Mineral but what it cleaves to. This Stone owes its Origin to the Acid of common Sulphur, which is the *universal Acid*, or saline Matter of all *Minerals*, but principally of *Iron*. And to consider the Thing closely, the *acid Exhalation of Sulphur* is continually breathing upwards from the lower Parts of the Earth ; mixes in among the *Waters* as they flow along their Channels ; associates it self with the earthy, irony Particles dispersed therein ; and thus forms it self into a kind of *vitriolic Principle*. This *Principle* manifests it self in *Mineral Waters* by striking a purple Colour with *Galls*, if the fine *Vitriol* be only in a small Quantity ; or by affording a deep Black, like that of *Ink*, if it be large : and this single Experiment may be safely depended upon for the Purpose, without the Concurrence of any other.

47. We have before intimated that the *vitriolic Principle* in *Mineral Waters* is of two Kinds, *volatile* and *fixed* ; but in all the most celebrated *Mineral Springs*, whether *hot* or *cold*, there is no *fixed Vitriol* to be found. But such *Waters* as are most impregnated with the fine *volatile, vitriolic Principle*, may deservedly be accounted the most efficacious. It is a sure Sign of their containing this *Principle* when the *Waters*, fresh taken up at the Spring-head, turn black with *Galls* ; but strike no Tincture at all therewith, after having been

been heated at the Fire, or exposed to the open Air. Which affords us a *capital Instance* of the strange Error of those who endeavour to discover and manifest the *Principles* or *Ingredients* of *Mineral Waters* by the sole Assistance of Exhalation, or Distillation; for by these Operations the *volatile, mineral Part*, wherein their principal Virtue consists, thus certainly flies off and escapes, along with their fine efficacious *Spirit*.

48. If any *Vitriol* remain behind after the Evaporation of the *Waters*, it may properly be called *fixed*; and has much less *Medicinal Virtue* than the former. And indeed there are some *chalybeate Springs* which afford a very minute parcel of this fixed *Vitriol*, obtainable by a particular *Encheiresis*. And the *Waters* that afford it do not only turn inky with *Galls*, but even with *Oak-Leaves*, *Pomegranate Bark*, *Extract of Tea*, &c. and thus yield a somewhat durable Tincture. But for the particular ways of separating and precipitating the *irony Principle* from these *Waters*; let a Dram of calcin'd *Oyster-shells* be put into a Pint of the *Water*, and the Mixture be kept well stop't for several Days; shaking the Vessel between whiles: by which means a fine yellow *Oker* will fall to the Bottom. A still better way is to put a new laid Egg into the *Water*; for thus a *yellow Substance* will collect it self, like Dregs, or flying Clouds, from all the Parts of the *Water*, and afterwards sink together to the Bottom. The same Effect will likewise be procured by exposing to the open Air, Bottles half filled with the *Water*: for thus the spirituous Principle coming to exhale; a very light and fine yellow Powder will be precipitated. For as 'tis the

noble *spirituous Principle* which detains and locks in the fine irony Matter with the *Water*; when that Spirit comes to be separated, the *Water*, which before supported the *Iron*, will no longer sustain it. But to obtain this irony Matter in the *crystalline Form* of *Vitriol* is a more difficult and curious Operation*.

*The Proofs
of com-
mon Salt
in Waters.*

49. It is likewise no unusual thing for *Medicinal Springs* to participate of *common Salt*; which is obtainable from them by a bare Exhalation of their Moisture: when, if the solid Matter remaining at the Bottom, be duly wash'd, clean'd from its drossy Parts, and exposed to *Crystallize*, it shoots into Grains, of a cubical Figure; crackles in the Fire; turns *Aqua fortis* into *Aqua regia*, or renders it capable

* It may be of some Consequence to have a clear Conception of this *vitriolic Principle*. The Question is, whether any true and solid *Vitriol of Iron* be naturally contained in *chalybeate Waters*; so as without Addition, to be separated from them. The Author maintains the Negative, from *Experience*; and has Dr. Lister, Mr. Boyle, the *Royal Academy of Paris*, and other experimental Philosophers on his Side. But that a solid *Vitriol* may by Art, and Addition, be procured from all *irony Matters*, is a well known Fact: and the secret way of preparing a *solid Vitriol of Iron*, here intimated by the Author, may perhaps depend upon calcining the Oker, or *irony Matter* of the *Water*, then dissolving it in an acid, and aqueous *Menstruum*; which will thus by Evaporation and Crystallination form into regular Shoots of green *Vitriol*. But no Solution can thus be made, unless the Oker or imperfect *irony Matter*, be first burnt or calcin'd. It is also an ingenious Expedient of Dr. Lister to procure regular Shoots or Crystals from the *Moulton Waters*; by rubbing the inside of the containing Vessel with a little *Alum*: which may possibly afford a Hint for procuring a true, solid *Vitriol* from *Steel Waters*, if they contain any. See *de Fontib. Medicat. Anglia*. Ed. Lugd. Batav. An. 1686. p. 33. But the whole Matter is hereafter farther cleared up.

SECT. III. 5, &c.

capable of dissolving *Gold*: all which are *infallible Signs* of *common Salt*. But a more easy and familiar Experiment, which proves the dry Matter to be *common Salt*, is to drop upon it a little *Oil of Vitriol*: for immediately upon this, a sharp pungent Spirit will arise, in Vapour, and strike the Nose, so as readily to manifest its Nature to those acquainted with that *Sensation* before-hand. Another certain Indication may likewise be had of *common Salt* residing in *Mineral Waters*, by dropping a little of the *Solution* of *Silver* into a parcel thereof: for if there be any *Sea-Salt* contain'd therein, the Mixture will immediately grow milky; and let fall a *white Powder* to the Bottom.

50. *Medicinal Waters* contain, as was above *The Proofs* observed, a *fixt alkaline Salt*; and some of *of an alkaline Salt in Waters* them a considerable Quantity thereof: so as to be obtained from them by Evaporation or the proper chemical Treatment. The certain Signs of their containing it are these, viz. (1.) The Conflict and Effervescence they make upon dropping any *Acid* into them; but especially Spirit of *Vitriol*. (2.) If the *Salt* procured from them by Evaporation be again dissolved, it changes *Syrup of Violets* from blue to green. (3.) The same *Solution* makes along with Spirit of *Vitriol*, that call'd by the Chemists *Tartarum Vitriolatum*. (4.) The same *Solution* turns a *Solution of Mercury Sublimate* to a yellow Colour. And (5.) if the *Salt* be mixed with *Sal-Ammoniac*, it sets free the volatile Part thereof; so that an *urinous Spirit* strikes the Nose, in Vapour, and thus becomes manifest to the Sense*.

E 3

51. Be-

* See above, p. 46.

Nitrum
Murale
in Waters.

51. Besides those already mentioned, there are a great Number of *Medicinal Springs* that contain a certain *Salt* which has hitherto no proper Name assign'd it; but remains in a manner unknown: being of a *neutral Nature*, betwixt *Acid* and *Alkali*, and of a moderate Temperature in its Virtues and Effects. It has commonly been abusively call'd by the Name of *Nitre*: for 'tis neither inflammable, nor crySTALLizes into a pyramidal Figure, nor affords an *Aqua fortis* by Distillation. We may therefore rather call it a *neutral Salt*; as it conflicts neither with *Alkalies* nor *Acids*, nor impresses a Sensation of Coolness upon the Tongue. Many *Springs* abound considerably with it; insomuch that some of them have afforded a quarter of an Ounce from twelve Ounces of *Water*. There are numerous *Springs* of this kind in *Germany*, about *Paris*, and in several Parts of *England*.

52. The first who took any notice of this *neutral Salt* was Dr. *Lister**, who calls it a *chalky* or *calcareous Nitre*. His Words are these. *To the Salts already mentioned must be added a fifth Kind, viz. a calcareous Nitre; the Crystals whereof are slender and long, with four Parallelogram and somewhat unequal Sides in the Middle; but the Point consisting of two plain triangular Sides*†. This *Salt* doubtless owes its
Origin

* *De Fontib. Medicatis Angliæ. Cap. 1. p. 13.*

† This *calcareous Nitre*, otherwise call'd *Nitrum Murale*, is thus more largely described by its Discoverer. "Tho' this *Salt* be little known, 'tis certainly the most common of all *Salts* in *England*; being the same as grows in, and may be generally extracted from the crude or calcin'd *Mortar* of old Walls. It shoots into long and slender *Crystals*, with four *Parallelogram* and somewhat unequal Sides, in the Middle; but
" one

Origin to the Combination of the universal or *sulphureous Acid*, and a *chalky Earth*; which is of an alkaline Nature: for the *Waters* being impregnated with this *Acid*, and running upon a chalky Bed, whereof there is great plenty in the Bowels of the Earth, they imbibe Particles of the Chalk in their Passage, and therewith form themselves into a bitterish *Salt*. This receives both Confirmation and Illustration by mixing the *Acid of common Sulphur* with any kind of *Alkali*; which thus produces a particular *neutral, bitter and cleansing Salt*. But 'tis extremely difficult by any Mixture or particular Signs, such as are before laid down, to discover the Existence of this *Salt* in *Mineral Waters*, on account of its Neutrality: but then there is an easy Remedy at hand; for it becomes manifest, and exhibits it self to the Eye, by the bare Exhalation of the *Water* to Dryness.

53. The common Opinion runs strong that there is *Alum* contained in many *Mineral Springs*; and the Experiment produced for it is, that by dropping *Oil of Tartar* into the *Water*, it becomes milky, in the same manner as a *Solution of Alum* would do. But this Experiment is fallacious; because all chalky and saline *Waters* lose their Transparency, and become white or milky, upon the Admixture of

E 4

any

“ one Point consists of two plain triangular Sides, and
 “ the other of two flat Squares. Sometimes the Shoots
 “ have five Sides in the Middle. By repeated Solution the *Salt* wholly concretes into this kind of
 “ *Crystals*; tho' few of them are thus obtained complete and perfect. When the *Salt* is thrown upon
 “ the Fire it melts, and rises in Blisters, without flaming, and hardens like the whitest *Pumice*, exactly
 “ after the manner of *Alum*.” See *Lister. de Fontib. Medicat. Angliae*. p. 6, 7. Edit. Lugdun. Batav. 1686.

any alkaline Liquor, or even a limpid *Lime-Water*. But a certain and infallible Proof of *Alum* in the *Waters* would be, if the white Powder, precipitated from them by the Addition of *Alkalies*, swelled and rose into a hollow spongy Mass when thrown into the Fire, or laid upon a red-hot Plate of Iron. But tho' in all our Experiments we have discovered no Signs of *Alum* in any *Mineral Water*, yet we do not deny but *Springs* may abound therewith, in those Places where *Alum-Stone* is found, and dug *. And indeed there are certain Instances of the Fact. But then such *Springs* should not be called *Medicinal*, or be used as such internally : for they are not only disagreeable to the Taste, by their Roughness, Austerity and corrosive Nature ; but also unwholesome and prejudicial to the Body.

*The Proofs
of Sul-
phur in
Waters.*

54. The Case is much the same with regard to *Sulphur*. 'Tis the general Opinion of Physicians that all hot *Springs* contain *Sulphur* or *Brimstone* ; and thence they strangely derive the Cause of their Heat. But in Fact there are very few hot *Springs* that contain any *Sulphur* at all ; and excepting one or two, there are not the least Marks discoverable of it in the rest. There are some Writers who, to defend their own Notions, with a show of Experiment, argue there must absolutely be *Sulphur* contained in all hot *Well-Waters* ; otherwise how is it possible the white Linen Shirts of such as bathe in them, should be tinged of a saffron Colour : but this *Stain* is owing to a very different Cause, and no Proof of *Sulphur*,

* In all the Experiments upon *Waters*, made before the Royal Academy of Sciences at *Paris*, as related by the *Sieur du Clos*, there appeared no Signs of *Alum*.

Sulphur, in the form of *Sulphur* ; but of some irony Matter. For my own part, I have taken great Pains by Experiments of all kinds, to discover, if possible, the Existence of this pretended *Sulphur* ; but all to no purpose, except in one or two *Springs*. Nay, I have with the utmost Exactness that I was Master of, examined such *Waters* as run hot, and with an abominable Stench, like that of putrefied Eggs, from the Spring, and such as have been firmly believed full charged with *Sulphur*, and particularly those near *Frankfort* on the *Main* ; but could not discover the least Grain of *Sulphur* therein. And to those who would satisfy themselves in this Particular, we recommend as *determining Experiments* for the Purpose, the two following ; which, if there be a real and substantial, or corporeal *Sulphur* existing in the *Waters*, will certainly discover it. The *first* is to suspend burnish'd Silver in the *Water*, to try if it will come out, not of a yellow, but of a dusky black Colour. The *second*, is to try if after Evaporation to Dryness, there be any inflammable Matter remaining behind that will burn blue ; and when melted with *Salt of Tartar*, make what the Chemists call *Liver of Sulphur*. And if it be pretended that these *Waters*, tho' they may not contain *Sulphur in Substance*, are yet impregnated with fine sulphureous Parts, to which their Virtue is owing ; tho' we do not absolutely disallow thereof ; yet to encourage their Industry in a Subject of this Consequence, we require not their Notions and Conjectures, but their Experiments and Observations : for nothing less than this will come up to the Point *. It

* That there are hot *Springs* abounding with *Sulphur* appears by the Account which *Dr. Browne* gives of the
Baths

*The Proofs
of Earths
in Waters.*

53. It remains, in the last place, to be examin'd, whether *Mineral Waters* contain any true, and solid *Earthy Parts*. Such a kind of Mixture in Waters may, to those unacquainted with chemical Experiments and Observations, appear contrary to Nature, as they call it; but tho' *Water* be no proper solvent of *Earth*, yet there is no *Water* without its *earthy Principle*. And we make no question, but this is a *Principle* that not only renders *Waters* wholesome; but likewise gives them some other Virtues. For it is certain, that the *Earths* found in different *Waters*, differ as much as those found out of Waters. Thus, the most common and frequent *Earth* of *Waters* is the *calcareous* or *chalky* *; which abounds copiously in hot and salt *Springs*: so that some of them afford, upon Exhalation, a hard, shining and concreted Substance, resembling *Asbestos*, or a kind of *Talc*. The *Waters* that have a fat Clay or marly Bottom, are of a better Kind; as *Earths* of this Nature render the *Waters* sweet, soft, and wholesome. Lastly, those abounding in a Substance like *Oker*, are highly medicinal on that account: and tho' this *Earth* owes its Colour to *Iron*; yet 'tis not dissolved by an Acid, because of its clayey or marly Nature: and therefore communicates a strengthening and drying

Virtue

Baths of *Austria* and *Hungary*. For he not only observed true *Flowers* of *Sulphur* sublim'd from some of them, and sticking to the upper part of the Pipes, thro' which the *Waters* run; but also that the *Waters* in a few Minutes turn'd *Silver* black, and heighten'd the natural Colour of *Gold*. See *Philosoph. Transact.* N°. 59.

* The *Lapis Calcareus* is, by Dr. Lister, made a *Genus*, under which he ranks all the *Stones* or *Earths* capable of being burnt into *Lim.* Hence *Chalk*, *white Marl*, *Flints*, the *Selenites*, *Gypsum*, the *Stalactites*, &c. are but Species of *Lapis Calcareus*.

Virtue to the *Waters* ; as appears by their Effects.

54. 'Tis somewhat difficult to discover the Existence of these *Earths* in *Waters* by any particular Signs or Mixtures ; and they can scarce otherwise be rendered sensible, but by evaporation. A *chalky Earth*, however, may be known upon dropping *Oil of Tartar*, or a *Solution of Sugar of Lead*, into the *Water*, and its producing a milky Colour : and if such *Earth* abounds plentifully therein, especially if it be the *Water* of a hot *Spring*, the *Earth* separates from it in the cold Air, strikes to the sides of the containing Vessel, and, in a short time, lines them with the Crust. After Exhalation, when the Bottom is reduced to Dryness, this *Earth* may likewise be discovered by the Effervescence it makes with *Acids* ; and again, by the extreme Sharpness it acquires upon a thorow Calcination. The Signs of an *Oker*, or *Irony Earth* in *Waters*, may be taken from the Sediment remaining after Evaporation and Crystallination of the *Salt* ; its appearing of a yellow Colour, and turning red in Calcination. But if any thing of a *stony Nature* be contain'd in *Waters*, it best manifests itself by frequent Washings in fresh Water ; where all the more subtile Parts are dissolved and thrown off ; whilst the heavier and merely *terrestrial Matter* settles to the Bottom, and cannot easily be stirred or wash'd away *.

55. From

* Dr. Lister found by Experiment, that many of the *English Springs* contain for their *Salts* no other than common *Salt*, and the *calcareous Nitre* ; and for their *Earth* no other than an *Oker*, or real *irony Earth*, and a *calcareous Stone*. See *De Fontib. Medicat. Angliæ Exercit. 1. Cap. 4.*

Conclusion. 55. From the whole of this Examination, into the ways of discovering and manifesting to the Senses, the *Principles* of all the different Kinds of *Mineral Waters*, we may draw this general *Conclusion*: That there are in reality but very few *Principles* of these *Waters*; whilst many have been attributed to them, by Men unacquainted with the true and proper ways of examining them, upon the only sure Foundation of chemical and philosophical *Experiments*.

S E C T. II.

*The ways of examining particular Springs,
in order to determine their Medicinal Vir-
tues and Uses.*

*Introduc-
tion.*

1. **A**S it is certain that *medicinal Springs*, whether of the hot or cold Kind, found in different Countries, differ considerably with regard to the *Principles* or Ingredients they contain; and again, in point of Purity of the *Waters*; whence some become serviceable in one sort of *Distempers*, and others in another; some of them useful in this Constitution, and some in that; it becomes a Matter of Importance to determine the precise Virtues and Efficacies of different *Springs*, by the Means of sure Experiments. And to lead others into a regular and just Method of doing this, or of discovering such *Springs* as are of greatest Efficacy for the Cure of Diseases in every Country, is the Design of the present Section. To render the whole Matter familiar and intelligible, we shall proceed

proceed in the instructive way of *Examples*, rather than *Precepts*; and lay down *Sets of Experiments*, that we have our selves made upon the *Waters* of certain *Springs* of the greatest Character and Reputation in *Germany*: whence at the same time we shall have an Opportunity of confirming their medicinal Virtues by *Experience*, and *Instances* of Persons who have drank them with Success; and thus of demonstrating their Virtues to be agreeable to the Contents, which our *Trials* manifest in them *.

I.

The ways of examining COLD-SPRINGS.

2. We begin with the *Pyrmont Waters*, which on account of their penetrating Nature, and quick passing off, hold the principal Place among *Cold Springs*. 'Tis remarkable of these Waters, above all others, that the Glass or earthen Vessels fill'd with them at the *Spring-Head*, and well stop'd down, easily burst to pieces, with considerable Violence, upon shaking or being gently treated. So that if Flasks of it are to be carried to distant Places, 'tis necessary not to fill them to the Top; or else to let them remain open for some Hours, that their volatile, elastic Spirit may in some degree fly off.

The Pyr-
mont
Waters
examin'd.

3. If

* The Reader will please to observe, that tho' the following *Experiments* and *Observations* were made upon the *Waters of Germany*; yet they answer the End for which they are here produced, as well as if they had been made upon the *Waters of England*, viz. that of shewing the particular Methods of discovering the Virtues and Uses of the *Waters* in all other *Countries*, by the way of *Example*.

3. If these *Waters* be drank cold, upon an empty Stomach, in the Morning, they not only briskly strike the Nose with a subtile penetrating Vapour, that rises from them; but also render the Head giddy, as if the Person had drank too much Wine.

4. They sometimes operate by Stool; and this the more powerfully when they are not drank at the Spring-head, but carried to some distance before they are used *. And the Matter they thus discharge out of the Body, is of a blacker Colour than happens upon drinking the *Waters* of other cold Springs. But they lose all their *purgative Virtue* by being long exposed to the open Air; and in that case do not tinge the Excrements black.

5. If *Tea-Leaves*, *Balaustian Flowers*, or powdered *Galls*, be thrown into a Glass of this *Water*, it first acquires a blue Colour, which soon after turns to a purple, and at length a black: which shews that the black Colour proceeds from a Concentration of the purple; and that the blue Colour is nothing more than a faint and dilute purple. But if a little *Spirit of Vitriol* be dropt into the *Water*, that is thus tinged, all the Colour presently vanishes.

6. If

* Dr. *Stare* finding upon Evaporation no bitter cathartic Salt in these *Pymont Waters*, will not allow them properly purgative; but attributes this Effect to their being drank hastily, or in large Quantities; in which case common *Water* would have the same Effect. See *Philosoph. Transact.* N^o. 351. But from the Account here given, they appear to be somewhat purgative; by means of their volatile, *vitriolic Spirit*; which is also vomitive, when it largely abounds in *Steel Waters*; as appears by an eminent Instance in the newly discovered strong, chalybeate *Waters of Passy* in France. See *Histoire de l'Academ.* An. 1720. pag. 46.

6. If any *acid Spirit*, whether of the stronger kind, such as *Spirit of Vitriol*, and *Aqua fortis*; or of the weaker, such as *Vinegar*, *Lemmon Juice* or *Rhenish Wine*, be mixed with this *Water*, it causes a manifest Ebullition, and throws up a large Quantity of Bubbles, to the Top, with Violence, and a vaporous Exhalation.

7. On the other hand, if any *alkaline Liquor*, whether of the fixt sort, as *Oil of Tartar*, or of the volatile, as a dilute *Spirit of Sal-Ammoniac*, be mix'd with this *Water*, no observable Conflict or Ebullition ensues: but the *Water* only becomes a little thick and white. And if now *Spirit of Vitriol* be dropt into it, so as to saturate the *alkaline Principle*, the *Water* again becomes pellucid and transparent.

8. Upon mixing an equal Quantity of Cow's *Milk* along with this *Water*, the *Milk* does not curdle, but rather becomes more fluid; and is by this means preserved from turning sour; which affords an indisputable Proof that this *Water* abounds not with an *Acid* *.

9. If *Syrup of Violets* be mix'd with this *Water*, it turns of a deep green Colour; which presently disappears again upon the addition of a few Drops of *Spirit of Vitriol*.

10. Upon evaporating forty-eight Ounces of this *Water* over a gentle Fire, we obtain'd two Scruples of a dry Matter; one half whereof being put into a proper Glass, we let fall thereon thirty Drops of *Oil of Vitriol*; upon which there arose a strong Ebullition, and a fine rarified Vapour,

* This Particular is farther confirmed of these *Waters* by Dr. Slare; who found they did not curdle *Milk* even when boiled, in an equal Quantity, with it: but caused the *Milk* to continue several Days without turning sour. See *Philosoph. Transact.* N°. 351.

Vapour, that sharply struck the Nose, in the same manner as when *Oil of Vitriol* is poured upon *common Salt*. Upon the other half of this dry Matter we poured some pure *Spirit of Vitriol*, which made a Conflict therewith and turned it into a bitterish saline Substance; leaving behind a considerable Proportion of a chalky Earth, which when washed in fair Water, no longer made any Effervescence with an *acid Spirit*.

11. Upon exposing several Pints of *Pymont Water* in a large Silver Vessel, for twenty-four Hours, to the open Air, we found it so much alter'd from its original State and Disposition, as scarce to be distinguishable for what it was: so sluggish and unactive it appeared. For to the Taste it had quite lost its mineral, brisk and penetrating Nature, and became perfectly insipid. It was also changed in its Transparency, and become thick and turbid, with a fine *yellowish Earth* fallen to the Bottom. And when the Liquor that floated above this *Powder* was poured off, it no longer made any Ebullition with an *Acid*, nor turned black with powder'd *Galls*; nor greenish with *Syrup of Violets* *.

The Doctrine of the preceding Experiments and Observations.

12. From these several Particulars it plainly appears, that the *Pymont Waters* very copiously abound in a pure, penetrating, elastic *Mineral Spirit*, whereon their principal, and distinguishing Virtue and Efficacy depend. For this highly rarified *Principle*, so long as it cleaves to the *earthy* and *chalky* Particles of the *Water*, assumes

* Those who desire to see how these Observations and Experiments upon the *Pymont Waters*, made at the Spring-head, agree with those made upon the same *Waters* when brought to *England*, may consult Dr. *Stare's* Account of the *Pymont Waters* given in the *Philosophical Transactions*, N^o. 351. Whence the Difference will not appear considerable.

fumes the Nature of an *Alkali* : but being also join'd with a subtile *irony Earth*, it resembles the Nature of *Vitriol* ; has a *vitriolic* Taste, renders the Excrements black, and makes an inky Tincture with Galls. Therefore whilst this *Principle* remains in the *Waters*, it thus renders them extremely active and powerful in opening Obstructions, and promoting the Secretions of the Body. But when once this *Spirit* is gone from them, all their medicinal and distinguishing Virtue and Excellence is lost, or goes off along with it. And as these *Pymont Waters* copiously abound with this *spirituous Principle*, and consequently have a strong Operation and Effect ; 'tis evident that the use of them is rather fitted to such as are of robust and corpulent Habits, than for Persons of a soft, delicate, and tender Constitution. Yet they may, with great Safety and Advantage, be drank by the Weak and Infirm, in a small Quantity ; or diluted with other pure and wholesome common *Spring Water*. They are also very advantageously mixt with an equal Quantity of *Milk* ; and thus become eminently serviceable to Persons troubled with the Gout, and Scurvy : of which we have seen numerous Instances, in our long Experience of these *Waters* *.

* Dr. *Slare* has taken some Pains to root out the strong Prejudice we commonly have to *Milk* in a Course of the *Steel Waters* : He expressly declares, that " he has frequently advised *Milk* to be given daily in the Evening, thro' a whole Course of the *Steel Waters*, " with good Effect ;" and affirms, " that some could not bear those *Waters*, unless mixed with a third or more of *Milk*." The Doctor adds, " nor do I find the least Reason to prohibit the Use of *Milk* in a Course of *Bath Waters*." See *Philosoph. Transact.* N^o.

The Wa-
ters of
Egra exa-
mined.

13. Next to the *Pymont* come the *Waters* of *Egra*; as nearly approaching them in Virtue: For altho' they do not abound so largely in *Spirit*, but are of a milder Nature; yet for this reason they are drank with more Success, and at present are more frequented than the *Pymont Wells*: an immense Quantity thereof is also yearly sent to foreign Countries.

14. Upon pouring *Spirit of Vitriol* into this *Water*, there arises a manifest Ebullition; tho' not so large as in the *Pymont Water*.

15. Upon mixing *Oil of Tartar* with this *Water*, it still remains transparent or limpid; without any Thickness or Foulness: whereas other *Mineral Waters* generally turn muddy or milky, upon dropping an alkaline Liquor into them; on account of the *common Salt* or *chalky Earth* they contain.

16. If this *Water* be fresh taken from the Spring-head, it turns purple with *Galls*; but alters not its Colour therewith, when carried to any great Distance; unless the containing Vessel were very exactly closed: which is a sure Indication that it contains extremely little, if any thing, of an *irony Earth*.

17. With *Syrup of Violets* it turns of a dilute Green: which shews that the *alkaline Principle* rather predominates in it.

18. A *Solution of the Vitriol of Iron*, being added to it, throws down yellowish Clouds, or a dreggy Matter to the Bottom: tho' this is rather owing to the *Vitriol* itself, that was added, than to the *Water*; which thus dissolves and spreads it, whilst the *Acid of the Vitriol* meets with the *alkaline Salt* of the *Water*, and lets go its fine Particles of *Iron*.

19. Upon distilling twelve Ounces of this *Water*, in *Balneo Mariæ*, we first obtain'd a perfectly

perfectly insipid Phlegm, and twenty-four Grains of a dry *saline Matter* at the Bottom: Upon this Matter we poured *Oil of Vitriol*; but there ensued no Struggle or Effervescence, nor any volatile Fume: which shews this *Water* contains no Proportion of *common Salt*.

20. Hence it is manifest, that the *Waters* of *Egra* owe their purging Quality to their large Quantity of *bitter cathartic Salt*; which is of a neutral Nature, in respect to *Acid* and *Alkali*: And this purging *Salt* is yearly prepared from these *Waters*, by boiling; and sent away, in very large Quantities, to foreign Countries. The *Salt* has no Virtue different from that commonly called *Epsom Salt*; and if an Ounce of it be dissolved in a Pint of Water, it purges advantageously; or gives three or four Motions without Disturbance. These *Waters* are also highly commendable on account of the Subtilty, Lightness and Purity of their *aqueous Part*; and may in this respect be preferred to the *Pyrmont Waters*, which abound with a copious *Oker* and a *chalky Earth*. 'Tis therefore agreeable to Reason and Experience, that the *Egra Waters* are well fitted for carrying off Viscidities, especially in the first Passages; and washing away the obstructing Matters in hypochondriacal Persons, or those of an ill Habit of Body; and discharging such Matters by Stool; and again, for opening Obstructions in the Blood Vessels of the *Viscera*, and dissolving any tough, clammy Humours lodged therein.

21. We next proceed to the *Seltz Waters*, which for their Excellence are celebrated far and near; and on account of the mild manner they act in, are drank with singular Advantage, even in extremely weak and ematiated Constitutions; especially by consumptive

The Doctrine of the Experiments.

The Seltz Waters examined.

Persons, or those of weak and unsound Lungs.

22. These *Waters* make an immediate Effervescence with any *Acid*, whether it be strong or weak ; and if mixt with *Rhenish Wine*, and a little powdered *Sugar*, they bubble up in a violent manner, with a crackling Noise, and Fume ; whilst the whole Mixture appears like frothing Milk.

23. When mixt with an equal Quantity of *old Hock*, they turn dusky, or appear of a brown redish Colour ; in the same manner as when *Oil of Tartar*, or strong *Spirit of Sal-Ammoniac*, is poured into a generous white Wine.

24. The Taste of these *Waters* is not sprightly, penetrating and tartish, like the *Waters* of other brisk *Mineral Springs* ; but somewhat lixivious upon the Tongue.

25. They turn not blue, or purple, much less black, with *Galls* ; nor tinge the Excrements inky, in the Course of drinking them.

26. With *Oil of Tartar* they turn milky ; but let fall no Sediment to the Bottom.

27. Twenty-four Ounces of this *Water* being gently exhaled away, left behind it a Dram and twelve Grains of a *saline Matter* ; which being again dissolved in Water, and passed thro' filtering-Paper, afforded a Lixivium, from whence we obtain'd two Scruples of a pure *alkaline Salt*. To a Solution of this *Salt* we put a Solution of *Mercury Sublimate* ; whence a fine *yellow Precipitate*, or *Turbith Mineral*, gradually fell to the Bottom. We had also the Pleasure of seeing an Infusion of *Rhubarb* turn'd into a beautiful red Colour by this Solution.

28. This same *alkaline Salt* also being mix'd with *Sal-Ammoniac*, bound up the Acid thereof, and set free the *volatile, urinous Part* ; so that

that it rose in Spirit, and briskly struck the Nose : which are all evident Signs of a *fixt Alkali*.

29. Having saturated twenty-four Ounces of this *Water* with *Spirit of Vitriol*, then gently exhaled away the Mixture to Dryness, we procured a Dram and a half of a *neutral Salt*, like to the *Tartarum Vitriolatum*.

30. We know of no *medicinal Waters* which so easily run into Putrefaction and Stench as these ; insomuch that the Bottle must be perfectly filled, exactly stopt down with Cork, and carefully pitched over, to preserve them sound.

31. If this *Water* be exposed to the open Air, in a wide Vessel, for twenty-four Hours, it entirely loses its original Taste, and becomes lixivious ; as if *Oil of Tartar* had been dropt into it : and yet there falls no yellow Substance to the Bottom.

32. An attentive Consideration of these Phæ- The Doc-
trine of the
preceding
Experi-
ments and
Observa-
tions. nomena will clearly shew, that this *Spring* plentifully abounds with the Matter of a pure *alkaline Salt* ; of which it contains a larger Quantity than any other in *Germany*. Yet it holds no bitter *calcarious Salt*, nor any *Principle of Iron* : whence it has no great purgative or astringent Quality ; but principally operates by Urine. Again, this *Spring* is but sparingly supplied with the fine volatile *Mineral Spirit* ; and for this Reason proves of a very mild and gentle Nature. All which being considered, it follows that these *Waters* are not only innocent, but may frequently be used with great Success and Advantage, even by such as are of the weakest Habit of Body ; and particularly in scorbutic, phthysical and nervous Disorders. They may either be used alone, or what is still better, mixed with *Ass's* or *Goat's Milk* :

which Method of drinking them I first, with good Success, introduced above five and twenty years since: and numerous Physicians, with the same Success, have followed my Example. I think I can assuredly affirm, that for diluting and washing off acid and ill-concocted Humours, correcting the ill Habit of the Blood and Juices in arthritical or gouty Persons, and for relaxing and restoring the contracted nervous Parts, there is not a safer, a surer, more immediate and effectual Remedy, than the *Seltz Waters* drank with *Milk*.

*The
Tonn-
stein or
Antonian
Waters
examined.*

33. We come next to the most noted *Spring* in all *Germany*; the *Waters* whereof are extremely pleasant to the Taste, and commonly called by the Name of the *Tonnstein Waters*.

34. These *Waters* have this in common with all other brisk and cold *Springs*, that they cause an Ebullition with *Acids*; and on this account, when mixt with *Sugar* and tart *Wines*, froth up, like *Milk*; with a great Smoke and hissing Noise: thus discharging numberless Bubbles, as it were in a thick Mist or Steam.

35. They afford no Tincture with *Galls*, but preserve their natural Clearness when mixed therewith: which shews they contain no *irony* or *vitriolic Particles*.

36. They turn *Syrup of Violets* of a faint Green, like all other sprightly, cold *Springs*: which shew they abound with an *alkaline Principle*.

37. If *Oil of Tartar* be dropt into them, they presently turn milky, and let fall a light Sediment: which shews they contain *common Salt*, or somewhat of a chalky Nature.

38. By standing, any considerable time, in an open Vessel, exposed to the Air, they also lose their pungent Taste and Transparency.

39. When

39. When evaporated in a Pewter Bason, set over the Fire, there appears a Skin upon their Surface, exhibiting various Colours; which is a Phænomenon that does not appear in other *Waters* of this Class.

40. Twenty-four Ounces of these *Waters* being evaporated to Dryness, there remained two Scruples of a solid Matter; which being again dissolved in fair Water, and properly dried, yielded one Scruple of Salt, and another of *chalky Earth*. The Salt was put into a Glass, and a few Drops of Oil of *Vitriol* poured thereon; which presently caused a great Ebullition, that sent out a thick pungent Vapour, exactly of the same kind as arises from a Mixture of *common Salt* and Oil of *Vitriol*.

41. Hence it plainly appears, that the *Tonnstein Waters* contain little *alkaline Salt*, but a large Proportion of *common Salt*, *chalky Earth*, and *mineral Spirit*; whence they prove of a mild and gentle Nature, so as to act powerfully neither by Stool, nor Urine. They may therefore, with Safety and Advantage, be used, both in chronical and acute Distempers, either alone, or mixed with *Wine*; so as to serve instead of *Malt Liquors*, which are very seldom proper in Distempers. They seem also capable of being still farther applied with Success, in the Cure of hypochondriacal Diseases.

42. The *Wildung Waters* have a great Affinity with those of *Tonnstein*; and are commonly used rather in the way of Diet than Medicine.

43. They afford manifest Signs of an *alkaline Principle*; as making a Conflict and small Effervescence with *Acids*. They also appear plainly impregnated with a fine *Mineral Spirit*; because if long exposed to the Air, they lose their peculiar mineral Taste.

44. They afford no Tincture with *Galls* or *Balaustian Flowers*; and turn but lightly green with *Syrup of Violets*.

45. Twenty-four Ounces of this *Water*, upon Exhalation, affords four Grains of *alkaline Salt*, and eight of an extremely white *Earth*, soluble in *Spirit of Vitriol*.

The Doc-
trine of the
Experi-
ments.

46. From these *Experiments* it may appear, that the *Wildung Waters* are of a milder Nature than any hitherto examined; and therefore highly proper to be used, either alone or with *Wine*, instead of the ordinary *Drinks*. And altho' they are not well fitted for overcoming obstinate, chronical Disorders, or cleansing the first Passages; yet they may be employed to good Advantage, for tempering and diluting the sharp Juices in *Gouty* and *Scorbutic Cases*.

The
Swalbach
Waters
examined.

47. The *Swalbach Waters* being kept in Bottles but lightly stoppt, they grow fetid, and deposite a *yellow Sediment*.

48. If fresh taken up, and mixt with *Galls*, they turn purple; and drank at the *Spring-Head*, tinge the Excrements somewhat blackish: which shews them inclining to an irony Nature.

49. They make an Effervescence with *Acids*; turn thick and milky with *Oil of Tartar*; and if exposed to the open Air, entirely lose their grateful Taste and laxative Virtue.

50. Twenty-four Ounces of this *Water* left, upon Exhalation, almost two Scruples of a *saline Matter*; a third part whereof was a kind of *Oker*.

The Doc-
trine of the
Experi-
ments.

51. Hence it appears, that the *Swalbach Waters* are of a middle Nature, betwixt those of *Egra* and *Pyrmont*; and may, by reason of their fine mineral Spirit, and subtile irony Principle, not only promote the Excretions, by Stool

Stool or Urine ; but at the same time strengthen those Offices of the Parts : and consequently are of great Use in hypochondriacal Cases.

52. Tho' we our selves have had no Opportunity of examining the *Waters of the Spaw*, yet we cannot omit giving some Account thereof, from the more eminent Writers upon them ; but especially from *Henricus ab Heer*, who has wrote an elegant Treatise thereon, entitled, *Spadacrene* ; and partly also from the *physical Essays of Vallerius*.

*The Spaw
Waters
examined.*

53. If the *Spaw Water* be carried to any great distance from the Spring, in well stoppt Bottles, it lets fall, after some considerable Time, a small Quantity of Matter like *yellow Oker*.

54. A single Grain of powder'd *Galls* will presently tinge an Ounce of this *Water* of a deep purple ; but if the *Water* be first heated, it changes not its Colour with *Galls*.

55. These *Waters* do not curdle *Milk* ; and when mixt with *Wine*, throw up a hot Steam, almost like boiling Water, that smells very gratefully, and exhibits an agreeable Sight of sparkling Bubbles to the Eye.

56. This *Water* seems to intoxicate ; but that Effect is commonly over in a Quarter of an Hour.

57. The *Spaw Water* is specifically lighter than common distilled Water, by one Grain in about an Ounce and a half.

58. Twelve Ounces of this *Water* yield, by Evaporation, a Grain and a half of a *white Powder*.

59. Supposing these *Experiments* just, it will appear from them, that the *Spaw Waters* are perhaps as light and subtile as any of the *cold Springs* ; their specific Gravity falling short of common distilled Water. And as they contain

*The Doc-
trine of the
Experi-
ments.*

tain but a small Proportion of Earth, or saline Matter, and a large one of the universal *Mineral Spirit*, 'tis easy to conclude they must have great medicinal Virtues; which are very fully express'd by *Henricus ab Heer*: who principally recommended the drinking of them in Diseases of the Bladder and Kidneys, the *Gonorrhœa*, and venereal Ulcers of the Mouth and Tongue. But besides these Virtues, which seem peculiar to the *Spaw Waters*, they have others in common with the cold *medicinal Springs* *.

*The Buch
Waters
examined.*

60. The *Buch Waters* make a strong Effervescence with *Oil of Vitriol*; and turn *Syrup of Violets* of a deep Green; but give no Tincture with *Galls*.

61. Upon dropping a Solution of the *Vitriol of Iron* into them, some light curdly Matter gradually falls to the Bottom.

62. Twenty-four Ounces of this *Water* affords, by Evaporation, twenty-two Grains of a *saline, alkaline Matter*; which being again dissolved, gives sixteen Grains of pure *alkaline Salt*, and six of *Earth*.

63. Upon dropping *Oil of Vitriol* upon this *Salt*, there arose a violent Ebullition, but no Vapour at all, like what *common Salt* would have afforded.

64. These *Waters*, tho' drank in a large Quantity, do not purge, yet operate powerfully by Urine; but if a proper Quantity of *Spirit of Vitriol* be added to them, it produces a *Salt* that immediately gives them a different Taste and a purgative Virtue.

65. They

* For farther Confirmation and Illustration of these Experiments and Observations, see Dr. *Stare's* Account of the *Spaw Water*, examined in England. *Philosoph. Transact.* N^o. 337.

65. They are impregnated with a copious *Mineral Spirit*; which flying off, leaves them in a manner insipid.

66. Hence 't plainly appears, that the *Buch Waters* excell, on account of their remarkable Purity, Lightness and Subtilty; and by being impregnated with a *saline Alkali*, and a copious *elementary Spirit*. But because of their adjacency to the *Egra Waters*, and the *hot Caroline Springs*, they are almost neglected by the Inhabitants; and the Physicians who practise there, seldom prescribe them; except while the Course of Bathing is in hand at the *Caroline Springs*. But 'tis somewhat strange that these *Buch Waters*, which, in *Medicinal Virtue*, do not fall short of those of *Seltz* and *Tonnstein*, should not be exported to other Countries; especially as they keep excellently, when the Bottles are well stop'd down.

II.

THE WAYS OF EXAMINING HOT SPRINGS.

67. Having thus shewn the way of examining the *Virtues of Waters*, by particular *Examples*, in several of the *capital cold Springs*, we proceed to the *hot* ones; and shall begin with the *Caroline Springs*, which, on account of their Reputation, require the first Place.

The Caroline Springs examined.

68. That these *Waters* contain a large Quantity of *alkaline Matter*, appears from the Effervescence they make upon mixing with any *Acid*; and their taking off the Sharpness of the strongest *Oil of Vitriol*.

69. The same thing also appears from hence, that twenty-four Ounces of this *Water*,
being

being gently evaporated, afford a Dram of a dry *alkaline Powder*, which readily makes a Conflict with any *Acid*; turns *Syrup of Violets* green, affords a *yellow Precipitate* with the *Solution of Mercury Sublimate*, and turns an *Infusion of Rhubarb* to a beautiful red.

70. A Dram of this *alkaline Powder* being dissolved again, and dry'd, affords half a Dram of *alkaline Salt*; and eighteen Grains of *Earth*: the remaining Part of the Weight being lost in the Experiment.

71. 'Tis remarkable of this *Salt*, that if it be prepared in a large Quantity, and long expos'd to the open Air, it becomes of a neutral Nature: by imbibing the *universal, sulphureous, acid Spirit* from the *Air*. And hence if it be afterwards melted in a Crucible, along with a third Part of powdered Charcoal, it turns to a Mass like the *Hepar Sulphuris*; from which, when dissolved, a pure *Brimstone* may be precipitated or regenerated.

72. That these *Waters* also contain a larger Quantity of *Earth*, partly of a chalky, and partly of an irony Nature, than any other *Spring* in *Germany*, appears not only from the milky Colour they acquire by the Addition of *Oil of Tartar*, and a Solution of *Sugar of Lead*, or *Silver*, which turns them milky, and throws a Sediment to the Bottom; but also from the vast Collections of a very hard Stone, somewhat resembling *Jasper* or *Marble*, which line the Sides of the Spring, and crust over the contiguous Planks: tho' this Stone appears somewhat softer and more brittle on the Insides of the wooden Pipes, thro' which the *Water* passes; as also on the Sides of the bathing Places.

73. From hence also proceeds the *white Skin* on the Surface of these *Waters*, when they have stood for four and twenty Hours in the Bath. This white and very subtile *Cream of the Water*, not only serves to cleanse and whiten the Teeth, dry up and skin over Ulcers, as well as the stony Crust lodged in the Pipes; but also makes a Conflict, and, in some Measure, dissolves with *Acids*: tho' one half of it thus remains undissolved; as being more gross and terrestrial than the other.

74. These *Waters* have this peculiar, that tho' drank as hot as possible, they prove strongly purgative; so as to occasion ten or more Motions downwards; whereas other Fluids taken too hot, prove astringent, and rather act by Sweat: Yet this purgative Virtue neither palls the Stomach, nor diminishes the Strength. 'Tis also remarkable, that upon the internal Use of these *Waters*, for some Days, the Feet generally swell: but this Inconvenience is presently removed, by three or four times Bathing. It must be observed, that the drinking of them, either cold or hot, is not without some Danger; as being very apt to stagnate in the Body, and pass with very great Difficulty, whether by Stool or otherwise. Those also who bathe in the *Water*, whilst it remains considerably hot, generally thence acquire the Head-Ach, Palpitations of the Heart, and fall into intermittent or even continued Fevers; especially if they have not drank the *hot Waters* first.

75. From a due Consideration of these *Experiments* and *Observations*, the Effects of these *Waters* seem justly assignable to the large Quantity of *chalky Earth* they abound with. For their purgative Virtue seems owing to nothing more than

than this ; that their alkaline, earthy, and chalky Matter, is dissolved by the Sharpness of the Juices, and acid Remains of the Aliment in the first Passages ; so as to degenerate into a neutral Salt that exerts a purging Quality, like that prepared with the *white Manganese* *, and Spirit of *Vitriol* : on which Principle the common *Epsom Salt* is, by Experiment, plainly proved to act. And if this *Earth* be not well diluted and dissolved, in the first Passages ; but the *Waters* come loaded and clogged therewith to the Mass of Blood, they must necessarily circulate with great Difficulty, thro' the fine Canals and capillary Vessels, especially those of the Head ; or even stagnate in these Vessels, and produce mischievous Effects. On Account therefore of this Crudity and Grossness of these *Waters*, it becomes necessary, not only in the Course of drinking them, but more particularly when the Course is over, to take some purgative Medicine, to prevent the fatal Obstructions they might otherwise occasion in the Intestines and Habit of the Body.

76. And as these *Waters* pass with Difficulty thro' the fine Canals, they must, of Consequence, stagnate in the weaker and relaxed Parts ; especially where the *Viscera* are touched or unsound ; and becoming here extravasated, increase their Disorders. It were therefore better for all phthysical, hydropical, and paralytical Persons to abstain entirely from the internal Use of these *Waters* ; or at least to use them

* The *white Manganese* is that chalky, alkaline Matter, obtained by evaporating and calcining the Remains of the Mother-Liquor, left upon the refining of *Salt-petre*, that will not shoot into Salt.

them with the utmost Circumspection. But all that is here said, regards only the common, violent *Spring*, called by the Natives the *Prudel*.

77. The *mild Spring* without the Town, which runs gentle, near the *Mill*, and thence called the *Mill-Spring*, is of a less dangerous Nature : And tho' of excellent Use, was formerly quite neglected. But coming to examine it almost thirty Years ago, and discovering its Excellence from the *Principles* it contained ; I advised the Use of it to several of my Patients, and persuaded some Physicians to do the like ; whence, by degrees, I brought it more and more into Request. And tho' the common Physicians at first oppos'd it violently, according to their Custom ; yet now it has for several Years been used, both externally and internally, by none but Persons of the first Rank ; and that with extraordinary Advantage and Success. For altho' the Phænomena these *Waters* afford, upon mixing with various Liquors, almost exactly correspond with those of the other *common, violently hot Spring* above-mentioned ; yet the present warm one is preferable on this Account, that it proves more purgative than the other ; and neither occasions the Sleepiness, nor Swelling and Distention of the Body, which that constantly does. Besides, Persons of the most tender and delicate Constitutions, those of weak Nerves, those subject to spasmodic Disorders, and Tremblings of the Joints, as also those afflicted with large Bleedings at the Nose, or otherwise, may both drink this warm *Water*, and bathe in it, without any Danger of such violent Symptoms as attend the external and internal Use of the scalding hot *Spring*. And if we closely
examine

examine into the Reason of this Difference, it appears to be that the *Mill-Spring* holds extremely little of that *chalky Earth*, where-with the other is strangely clogged ; and therefore proves much more subtile and light than that. For the *Mill-Spring* does not deposite any stony or thick crusty Matter on the Sides of the Pipes thro' which it passes, nor in its Receptacles. And if twenty-four Ounces of the *Water* be exhaled, it leaves a Dram of a dry Matter ; which by the proper Operation affords two Scruples and three Grains of an extremely pure *Salt*, and but five Grains of an *earthy Substance* : whereas twenty Ounces of the *Water* of the other *Spring* yields but half a Dram of *Salt* ; and full seventeen Grains of *Earth*. Lastly, the *Water* of the *Mill-Spring*, besides an alkaline *Salt*, affords one that is bitter and neutral, exactly resembling that called *Epsom Salt*. And this may be easily got from it, and rendered visible by dissolving twelve Ounces of the *alkaline Salt*, in twice its Quantity of *Water*, and setting it in a wide Glass Vessel to exhale upon a Sand Heat ; for thus the neutral *Salt*, as being the heavier, will fix to the Bottom and Sides of the Glass ; whilst the *alkaline, lixivious Salt* still remains dissolved in the *Water*.

The Aken 78. The famous *hot Springs* of *Aix la*
hot Wells, *Chapelle* have a great Affinity with the *Caro-*
or Waters *line* ; like which they are violently hot, and
of Aix la throw up, and strike to the Sides of their
Chapelle, Conduits, a vast Quantity of *stony Matter*.
examined. The *Cream* they afford is also insipid, like
 that of the *Caroline Waters* ; and floats upon
 their Surface, whilst they remain warm : and
 if this *Cream* be thrown into the Fire, it neither
 crackles nor melts ; but remains fixt. These
Waters

Waters have not only the same purgative Virtue with the *Caroline*, which is not so common in other *hot Springs*; but also the *Experiments* made with both, and the *Phænomena* thence resulting, differ but little. Thus they both make a Conflict with *Acids*; turn milky, and let fall a *Precipitate*, with *Alkalies*; shew no Blackness with *Galls*; and upon Exhalation leave an *alkaline*, or, in some degree, a *neutral Salt*, behind them. Twelve Ounces of the *Aix Waters* afford twenty-five Grains of *Salt*, and five Grains of *Earib*. But herein they differ; for the *Aix Waters* have this peculiar to them, that they turn Silver of a dark Colour, which is a manifest Sign of their holding somewhat sulphureous, or of the same Nature with common *Brimstone*; insomuch, that at the *Spring-head of the Casarean Bath*, there may sometimes be collected several Pounds of true *Flower of Brimstone*, sublimed by the Heat, and sticking to the Arch and Top of the Well-room.

79. On account therefore of the *Sulphur*, the *alkaline*, and the *neutral Salt*, which they plentifully contain, these *hot Springs* have some particular and extraordinary Virtues, in correcting and remedying external Disorders. For whilst they powerfully dispel the morbid Humours deeply fixt upon the tendinous and nervous Parts, they soon disperse and cure all Tumefaction, Pain, Trembling, Numbness, and paralytical Disorders of the Limbs; and at the same time, by their strengthening and contracting Virtue, support and confirm the Parts, that were too much unbraced and relaxed: so as to take away all Inability and Indisposition to Motion. They also mollify the hard Ligaments in gouty Cases, cure Contractions,

and all cuticular Diseases ; or restore the Skin when any way eaten or corroded by sharp Humours lodging under it. These *Waters* are likewise proper in spasmodic Disorders of the Nerves and Membranes ; and therefore of Service to Persons of hard, swollen or distended *Viscera*. Lastly, these hot *Waters* are of eminent Service in Female Disorders ; so as to prevent Miscarriages, promote Pregnancy, cure the white Flux, and effectually open Obstructions in the uterine Vessels, and forward the menstrual Discharge.

*The Emb-
sene hot
Springs
examined.* 80. The *Embsene Waters* plentifully abound with *alkaline Salt* ; infomuch, that twenty-four Ounces thereof contain a Dram of that *Salt* ; which readily makes an Ebullition with *Spirit of Vitriol*, and thus concretes into *Tartarum Vitriolum* : which when again dissolved in *Water*, and exposed to the cold *Air*, coagulates into a solid Mass. These *Waters* also throw up a large Quantity of Bubbles ; and make a gentle Effervescence, upon being mixed with any Acid. They turn thick and milky with *Oil of Tartar* ; green with *Syrup of Violets* ; and dusky with *Galls*. Hence it plainly appears that these *hot Waters* have a great degree of Subtilty, Purity, are not clogged with *earthy Particles*, and consequently become fit for Persons of tender Constitutions ; as being well adapted for running thro' the finer Vessels of the *Viscera*, dissolving the gross Humours that may be lodged therein, and carrying them off by the urinary Passages ; yet so as to strengthen and support the weakened Parts. Whence they prove highly serviceable in Contractions of the Limbs, Relaxations, and spasmodic Disorders.

81. The

81. The *Wisbad Springs* were famous in the Times of *Tacitus*. The *Water* makes a small Effervescence with *acid Liquors*; turns thick and white with *Oil of Tartar*; and upon the Exhalation of twenty-four Ounces, leaves half a Dram of a dry Matter behind: which seems to approach the Nature of *common Salt*; both by its crackling in the Fire, making an Ebullition, and raising a white pungent Vapour, with *Oil of Vitriol*. From whence we infer that these *hot Springs*, besides an *alkaline Principle*, contain also some Proportion of *common Salt*; to which their purgative Virtue is owing. They also contain a subtile *Oker*, which they throw up plentifully; so as to line the Sides and Confines of the *Spring* with a thick *yellow Crust*. From all which there is no room to Question but these *Wisbad Waters* have a great Medicinal Virtue; and might advantageously be used in many Distempers. And tho' formerly they were only employed externally; yet now for these last twenty or thirty Years, they have been found eminently serviceable in many Cases, when taken internally. *

The Wisbad hot Wells examined.

* Several of the above-mentioned *German Springs* have been likewise examined by that eminent Chemist *Urbanus Hierne*, chief Physician, and *Metallic Counsellor* to the King of *Sweden*: who spent six Summers upon this Enquiry: and his Experiments appear to agree with, and confirm those here delivered. Vide *Urban. Hierne Acta & Tentamina Chémica in Regio Laboratorio Stockholmiensi*, Edit. *Holmiæ*. An. 1712. p. 71, 72, &c.

III.

The Ways of examining such SPRINGS as have a particular Nature and particular Principles.

82. We have hitherto examined such *Medicinal Springs* as come under the general Names of *Acidulæ* and *Thermæ*, or *Brisk* and *Hot*; but in reality owe their operative Matter in part to an *alkaline Principle*. We next proceed to examine such as fall not under either of these Denominations, but are of their own peculiar Nature; and abound with very different Principles. And among these we shall give the first place to such as receive their Virtue from an *irony Substance*; whence they have been anciently called STEEL WATERS.

Of Steel
Waters.

83. Among STEEL WATERS we reckon the *Waters* of *Radeberg*, *Lauchstad*, *Bebran*, *Freyenwald* and *Weissenburg*; all which, if carefully examined, are found to contain no other visible effective Matter, besides a very fine *Crocus of Iron*, commodiously received and harboured in an exceeding light and elementary *Water*. For they do not manifest, nor so readily lose their copious, fine, spirituous Part as the others above-mentioned; nor participate of an *alkaline Principle*: as neither making an Effervescence with *Acids*, nor turning *Syrup of Violets* green. They also differ from most other *Medicinal Waters* in this, that they turn of a black purple with *Galls*; and when long exposed to the open Air, or boiled, they let fall a *yellow Sediment*. Nay, the Matter they throw up manifestly exhibits

exhibits to the Eye their peculiar Nature, and the *irony Principle* they abound with : for not only the Confines of the *Spring* are sometimes coated over with a *yellow Oker* ; but the Infides of the Pipes are lined with the same kind of Crust ; and a like Substance they deposite after standing some Weeks. This *oker* Matter proves, upon Examination, to be no other than *Iron* reduced to a *subtile Flower*, or a natural *Crocus Martis*, like the artificial ; as appears from hence, that it may not only by Calcination be converted into a true *Crocus* ; but also, if mixed with an equal Quantity of *Sal-Ammoniac*, and put into an ignited Crucible, there arise from it, bright and fragrant *Flowers* ; which, being collected and thrown into *Spirit of Wine*, afford an excellent *Tincture of Iron*.

84. To examine the *Medicinal Virtue* of these *Steel Waters* ; we shall find them endued both with an *operative* and *strengthening Property* ; so as to be advantageously used as well internally as externally. Thus when drank they loosen the Belly, but strengthen the Body and Stomach, provoke the Appetite, and may therefore be very safely and serviceably used in such Distempers as give way to any Preparations of *Iron*. Their external Use, in the way of Bath, is very considerable, for strengthening and cherishing benumbed and motionless Limbs ; curing Pains, Contractions, or Relaxations ; and for drying and healing up old Ulcers. And tho' used for this Purpose, in the way of Bath, made but gently warm ; yet they heat the Body, open the Pores of the Skin, and provoke Sweat ; especially if the Patient goes directly from the *Bath* to Bed.

Of bitter
purgings
Waters.

85. There are other *Medicinal Springs* which can neither be reckoned among the *Acidulæ*, *Thermæ*, nor *Steel Waters*; but are of their own peculiar Nature; and contain a pure, *neutral, bitter, purging Salt*. These Kind of *Springs* are very rare in *Germany**; and none of them known to this Day, besides those which I some Years since discovered at *Sedlitz* in *Bohemia*; and after having carefully examined their *Principles*, taught their Use, and introduced them with good Success.

86. Before I came to examine this noble *Water* it had never been of any domestic Use: only there run a Rumour among the Inhabitants that half a Pint of it would purge. There was this Remarkable observed of it, that tho' in the Winter, and in rainy Weather, the *Spring* flowed much freer than in the Heat of Summer, yet it always retain'd the same Taste; and, as I afterwards found, the same Virtues, and Quantity of *Salt*. For an Instruction to others who may happen to be less versed in the Examination of unexperienced *Springs*, I shall here deliver my whole Procedure on this Occasion.

(1.) I first poured a Quantity of the *Water* into a clean, crystal Glass, where it appeared perfectly limpid, and transparent; but to the Taste proved remarkably bitter and saline. (2.) I then let fall into it a few Drops of the stronger *Acids*; such as the *Spirit of Vitriol*, *Spirit of Nitre*, &c. but perceived no Signs of any Ebullition: and as it turned not green with *Syrup of Violets*, I was hence well assured it abounded with no *alkaline Principle*. (3.) It did not

* But very common in *England*; for those of *Epsom*, *Dulwich*, *Northall*, &c. appear of this Kind.

not turn purple upon mixing with *Galls*; which shewed it contained no *irony Substance*. (4.) Upon mixing with *Oil of Tartar* it grew somewhat thick; as generally happens when any *chalky Earth* is harboured in *Water*. (5.) Upon a slow Evaporation of twelve Ounces thereof, I obtained two Drams of a *bitter neutral Salt*, like that in *England* called *Epsom Salt*.

87. Upon the Strength of these *Experiments*, I recommended the *Waters* to the Physicians near the Place; to be used instead of the rough and coarse *Purgatives of the Shops*; and intreated them to go upon a fuller Discovery of its Virtues: but scarce any one of them thought me worth their Attention; till a very favourable Opportunity happened to establish the Reputation of these *Wells*. For in the Spring of the Year 1721, when the *Empress* came to the *Caroline Waters*, she made use of those of *Sedlitz*, in the Presence, and by the Advice of her chief *Physician*, whom I had acquainted with my Discovery; and before whom I afterwards repeated my *Experiments*: upon which we, with Caution, gave of the *Waters* to Persons labouring under *intermitting Fevers*, to great Advantage. This excellent *Physician* afterwards returning to *Prague*, along with the *Empress*, recommended these *Waters* to the Nobility of *Bobemia*; upon which an immense Quantity of them was sent both to *Prague* and *Vienna*, where they were fully approved for purging advantageously, and strengthening the Stomach. And in the Autumn following, the Nobility and Gentry of *Bobemia*, who yearly flock to the *hot Wells* at *Toplitz*, drank these *purging Waters* with great Success. And now the Fame of them reached to *Dresden*, *Berlin*, and others of the most con-

The Salt
of the Sed-
litz Wa-
ters.

siderable Cities ; where at present they use the *Sedlitz Waters* as common as those of *Egra*.

88. But as the principal Virtue of these *Waters* resides in their *Salt* ; and as the Carriage of them to distant Places is troublesome and expensive ; I persuaded a *Chemist* of *Toplitz* gently to evaporate the *Water*, so as to obtain its pure *Salt* for publick Sale : and the Event proved answerable to our Expectation ; for he now yearly disposes of very large Quantities thereof ; and sends it to distant Countries.

89. The Character of these *Waters* being thus established, I went upon examining more narrowly into the Nature of the *Soil* adjacent to the *Spring* ; and the Search was attended with this Advantage, that we discovered another *Spring* near *Seydschutz*, not far distant from *Sedlitz* ; tho' it lies somewhat higher ; flows in plenty ; and has a bitter and more saline Taste. And it seems, upon the whole, unquestionable, that this *Spring* runs down to, and supplies the *Waters* at *Sedlitz*. The Principles however of this *Spring*, and the Nature of its *Salt*, differ not from those of the other : for upon Examination they both exhibit the same Phenomena ; tho' the latest discovered affords the largest Quantity of *Salt* ; twelve Ounces thereof yielding two Drams and ten Grains, and six of a *chalky Earth*. The Reason seems owing to this ; that the *Spring* which lies higher is less exposed to the Reception of the *Rain-Water*, than that of *Sedlitz* ; which lying lower may be easily weakened by the Rain, or the Admixture of other *Waters*.

90. As this *Salt* has a great Relation to that called *Epsom Salt*, we will here deliver the Experiments we made on both ; the better to manifest

manifest the peculiar Nature of each. The learned Dr. Grew was the first who from the *Waters* of *Epsom*, prepared such a Kind of bitter, purging Salt; and wrote an elegant *Treatise* on the Subject. * But as twelve Ounces of the *Epsom Water* will not afford above half a Dram of Salt, 'tis certain that the Salt which commonly goes by the Name of *Epsom Salt*; and is sent into foreign Parts, in large Casks, and sold for less than Six-pence the Pound, cannot be prepared from those *Waters*, but is rather an artificial Thing. And in Fact 'tis not only prepared in *England* from the *Bittern*, or bitter Liquor that remains after the making of common Salt; but also at *Leipsick*, and other Parts of *Germany*, in very large Quantities. And it appears plainly, that a certain aluminous Acid, mixt along with the alkaline Earth of common Salt, is contained in the *Bittern* which affords it †. But it's remarkable, that all Salt-Springs do not yield this neutral, purgative Salt; perhaps only because the Salt *Waters* do not run upon Beds of *Alum-stone*.

91. (1.) The *Sedlitz Salt* is of an opaque, Snow-white, or milky Colour; but the *Epsom Salt* more transparent and watery: whence its greater

* This *Treatise* was originally published in *Latin*; but translated into *English* by Dr. Bridges, and printed, with *Notes*, at *London*, in 1697.

† Dr. Høy was the first who discovered the way of preparing this *Sal Catharticum Amarum* from *Bittern*; but now the Secret is grown common: Tho' the best way of purifying and perfecting the Salt, seems not yet known. For the common way of making it, see the *Philosophical Transactions*, N^o. 378 and 379. For purifying and imitating it with *Alum* and Salt of *Tartar*, see *Histoir. de l'Academ. An.* 1718. p. 38, 39. But for improving upon it, let Tryal be made with the white *Manganese*, and pure Spirit of *Vitriol*.

greater specific Gravity, and Disposition to relent in the Air. (2.) The *Sedlitz Salt*, whether in a solid Form, or dissolved in *Water*, tastes much bitterer and more nauseous than the *Epsom*. (3.) Both of them, when thrown into an ignited Crucible, melt and lose one half of their Weight in a watery Vapour; but the *Sedlitz Salt* flows clear and thin like *Water*, whilst that of *Epsom* is more viscous and tenacious. (4.) Neither of them in the least dissolves with the highest rectified *Spirit of Wine*. (5.) Both of them melt, along with *Pot-ash* and powdered *Charcoal*, into a Mass like the *Hepar Sulphuris*: but the Mass made by the *Epsom Salt*, turns with *Water* of a much deeper green Colour than the other; and when the Solution is precipitated with an Acid, affords a much larger Quantity of *Lac Sulphuris*. (6.) Both of them, when mixt with *Vitriol*, calcin'd to Redness, and put into an ignited Crucible, send out a Vapour like that of *Spirit of Salt*: and this Vapour is soon followed by that of the *volatile Spirit of Vitriol*. (7.) With *Syrup of Violets* the *Sedlitz Salt* turns green, but the *Epsom* blue. (8.) A Solution of either coagulates with *Oil of Tartar*; so that scarce any thing falls out when the Glass is inverted: but the *Sedlitz Salt* coagulates strongest. (9.) In like manner, a clear Solution of either becomes very turbid upon the Addition of *Spirit of Sal-Ammoniac*; and affords a large Quantity of curdly Matter. (10.) An Ounce of *Water* will dissolve an Ounce and two Scruples of *Sedlitz Salt*; but only an Ounce of the *Epsom*. (11.) A rich Solution of the *Sedlitz Salt* appears of a yellow Colour; whilst that of the *Epsom Salt* remains limpid, without discolouring the *Water*. (12.) The

(12.) The *Crystals* they both afford by Solution and Evaporation, scarce differ at all; except that those of the *Epsom Salt* are larger and more beautiful, in some sort resembling *Nitre*. (13.) The *Epsom Salt*, being kept for some Days upon a *Sand-heat*, loses its Transparency; and becomes in Appearance like that of *Sedlitz*: from all which 'tis manifest that these two *Salts* have a great Affinity, as well in their Principles as their Nature and Virtue.

92. The Experience of such as have drank these *Sedlitz Waters* confirms them serviceable for washing off all crude, viscid, acid, bilious and corrupted Humours, lodged in the Stomach and Intestines; and this in so safe, easy, and agreeable a manner by Stool, that nothing seems better disposed, nor more effectual for the Purpose. Other *Medicinal Waters*, tho' they may move the Belly, yet require to be drank in large Quantities before they will operate; and therefore easily pall the Stomach: whereas these operate quick, and in a small Dose; so that three or four Tea-Cups full generally prove sufficient; and the strongest Constitutions scarce require more than a Pint. There is also this Property attending these *Waters*, that they require not to be used for any long time; but only for eight or ten Days at most: and that too intermediately. And as they exceed other *purging Waters* in the Quickness and Efficacy of their Operation, so their Wholesomeness and purgative Virtue recommend them before all other purging Medicines in Use; scarce one whereof but operates more or less than was intended, weakens the Patient, gives him a Sickness at the Stomach, and lessens his Appetite: whereas the *Sedlitz Waters*, tho' they purge briskly, have none of these ill Effects;

Effects ; nor occasion Dryness of the Mouth : but rather by their Bitterness relieve the Stomach and provoke the Appetite. We can therefore assuredly affirm that there is not in any Dispensatory, nor in all the Catalogue of Drugs, a Purgative that operates with such Safety, Efficacy, Agreeableness, Quickness and Certainty as these *Waters*. And in Case of hypochondriacal Disorders, I never found any thing so serviceable as this *Water*. And I have known several who remaining highly costive for many Years together, recovered, by the Use of this *Water*, the natural Habit of other Men in that particular. These *Waters* are also found eminently serviceable in ill Habits of the Body, Obstructions of the menstrual Discharges, at the time when they first begin to stop, or towards the decline of Life, in scorbutic Cases, in Dispositions to the Piles, against Worms in the Body ; and in short, for curing and preventing many other Distempers, if drank with the necessary Rules and Cautions.

93. As these extraordinary Virtues of the *Waters* seem principally owing to their *Salt* ; it is proper to enquire whether the *Salt* could not be obtained from them, so as to produce the same good Effects. 'Tis certain that a *Salt* may be thus procured, which being dissolved in *Water*, shall make that *Water* have some Resemblance with those of the *Mineral Spring* ; but whether any Art can make the Imitation perfect, and in all respects equally serviceable with the natural *Water*, may be questioned. For 'tis evident, upon Experience, that there is a great Difference betwixt such *Mineral Waters* as are taken up at the *Spring-head*, and such as are artificially prepared by dissolving

dissolving the Contents of the same *Waters*, gained by Evaporation, in the purest *Spring Water*: for the artificial do not pass so readily thro' the Body, nor so effectually raise a languid Appetite, increase the Strength, nor purge so well as the natural. And this evidently appears in the present *Waters*, which being drank at the *Spring-Head*, or elsewhere, out of Vessels well stoppt, have not only a bitterer Taste than if the same Quantity of *Salt* they afford, were dissolved in a less Proportion of fresh Water; but also scarce six Drams of the *Salt* will not purge so often as a Pint and a half of the *Waters* themselves; which contain but three Drams of *Salt*. Whence these natural *Mineral Waters*, besides the fixed saline Particles, intimately mixed therewith; are likewise impregnated with a subtile, tho' insipid aerial *Principle*, that by its Fineness and Elasticity, forces its way, thro' the slender Cavities of the Canals; and, as it were, opens the Passages for the *Water* to follow it; in such a manner, as greatly to increase its Operation: and this is not only to be understood of *purging Waters*, but of all other *Mineral Springs*. For a free Access of the Air, and the Heat of the Fire, strangely alters, impairs, and destroys the Connexion, Arrangement, and Mixture of the Parts, which give *medicinal Waters* their Virtue and specific Efficacy.

94. If therefore the Attempts of this kind should fail, we might have an Eye to the Production of some other *Salt*, wherewith to impregnate *common Water*, in imitation of the *purging Waters*. Thus *Glauber's* artificial *Salt* has some Resemblance with the *Epsom Salt*; and proves, if the Point of Saturation be exactly hit, a *Salt* of a neutral Nature; of a bitter Taste,
and

and a purgative Virtue. But its Taste is much more pungent than either the *Epsom* or *Sedlitz Salt*; tho' it contains a larger Quantity of Water: insomuch that if laid upon a warm Sand-Furnace, it melts and runs like Water, and loses one third of its Weight. Again, if dissolved in an equal Quantity of Water, and exposed to the Air, it coagulates into a solid Mass. On the other hand, if *Oil of Tartar* be added to the Solution, it does not coagulate as the *Sedlitz* and *Epsom Salts* do. However there are several other *neutral Salts* procurable, by means of *Oil of Vitriol*, not only of a bitter Taste, but also, when given largely, purgative; of which kind is the *Arcanum Duplicatum*, or *Tartarum Vitriolatum*. But then again, the Bitterness and purgative Virtue is much greater in the *natural Salts*; and their Parts more subtile: as plainly appears from hence, that these *natural Salts* readily dissolve in about an equal Quantity of Water; whilst the artificial require four-times their own Quantity to dissolve them.

Of Saline Springs. 95. Besides the above-mentioned *purgative Waters*, that abound with a bitter neutral Salt composed of a chalky and an acid Principle; there are many others, as that of *Ratzeburg*, &c. which afford not only a *calcareous Salt*, but a considerable Quantity of *common Salt*. And these kind of *Waters* are of considerable Use for cleansing the Stomach and Intestines of tough, viscid Humours; restoring the Appetite, promoting Digestion, and remedying such Crudities and Flatulencies, as produce spasmodic Disorders in the remote Parts of the Body. But 'tis not proper to drink them in any large Quantity, or for any length of time; whence they are less suited to those Diseases which seat them-

themselves deep in the *Viscera*, and proceed from Obstructions therein ; because a long Use of *Waters* is required to remove those Obstructions from the fine Canals, whereof the *Viscera* consist. They may however be fitted to this Purpose by mixing and diluting them with other *Waters* *.

96. There are other *Springs*, which upon the strictest Examination scarce manifest the least Signs of a *neutral* or *alkaline Salt*, or of a *mineral* or *irony Earth* ; and yet are highly valuable on account of their extreme Lightness and Subtily : and of this kind there are several hot as well as cold *Springs*. A hot *Spring* of principal Note of this kind, is that of *Toplitz* ; where the *Waters* are extremely hot, and nearly resemble the *Piperine Springs* in *Rhetia*, which continue to run from the Month of *May*, when the Sun begins to dissolve the Snow upon the Tops of the Mountains, to the end of *September*. And altho' these hot *Waters* of *Toplitz* hold not the least *saline* or *earthy Matter*, so that when mixed either with *acid* or *alkaline Liquors*, they preserve their natural Clearness, and after a total Evaporation leave no solid Substance at the Bottom ; yet they have considerable Virtues upon account of their Purity and Lightness : in both which respects they exceed even fine rain Water. And hence they become highly serviceable in the way of Bathing, for the Cure of external Disorders ; as in Contractions, Dryness, Rigidity, Stiffness, and want of Motion in the Limbs ; by relaxing and strengthening the Fibres, and giving a due Circu-

Of simple Springs.

The hot Wells at Toplitz.

* Hence appears the Reason why the direct *Salt Springs* are not considered as medicinal ; except with regard to their *purgative Salt*, obtain'd from the *Bittern*. See above, p. 89, &c.

Circulation to the Blood and Spirits. They also prove beneficial in this way, where the internal tendinous and nervous Parts are affected; as in hypochondriacal Disorders, the Cholick, the Asthma, Contractions and Distentions of the Limbs; especially if the Bath be not too hot, but lukewarm. Whence 'tis my constant Advice to have these Waters fetcht home, and a Bathing-tub fill'd with them; because Persons cannot well bear the excessive Heat of the Bath: and therefore the Spring without the Town, commonly called the *Sulphur Bath*, is of much more frequent Use, and found wholesomer; tho', excepting its temperate Heat, 'tis exactly of the same Nature as that within the Town. And as all Physicians agree, that the lightest and purest *Waters* are the wholesomest; and as the *Piperine Springs* afford an eminent Instance hereof; no doubt but the *Toplitz Waters*, tho' drank cool, may prove serviceable in many Distempers; notwithstanding the Custom of drinking them is not introduced, any farther than the mixing of them with Wine.

97. This Subtilty, Purity and Levity, is also the true Reason of the Virtue and Efficacy of some other *Springs* in the Cure of Distempers; and particularly the *Schlangenbad Springs* of *Hesse*, which contain no saline, earthy, irony, or other mineral Principle, that can by any Art be extracted from them; and are no other than an extremely simple, pure and light *Water*: which nevertheless, both by drinking and bathing, has very remarkable Virtues and Effects. The same Reasons recommend the *Schleusing Spring*, called in the German Language, *Wilbems-brunn*; for these *Waters* have all the Marks of Purity and Excellence, and
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if put into the *exhausted Receiver*, throw up abundance of Bubbles; do not grow thick, or precipitate any thing upon the addition of *Oil of Tartar*, a Solution of Silver, or Sugar of Lead; but leaving all their Impurities in their Passage thro' the sand and stony Beds, receive no change from the common Experiments of *Galls, Acids, Alkalies, &c.* and when evaporated, leave no earthy Substance behind them. Hence the purer and lighter such Waters are, the more they should be esteem'd; as their Wholesomness, and Power of curing many chronical Disorders depends thereon: For thus they are fitted for readily entering the finest Vessels of the Body; and for dissolving and carrying off viscous Humours.

98. From the several preceding *Examina-* The gene-
ral Doc-
trine of the
preceding
Experi-
ments.
tions we conceive it plainly appears, that Man-
kind are liberally supplied with *Medicinal*
Springs, of different Natures, admirably suited
to the Cure of different Distempers. Thus,
for Example, if the first Passages of the Body
require to be cleansed of their grosser Excre-
ments, there are numerous *Springs* that answer
this Intention, beyond all Comparison better
than the *Medicines of the Shops*: in particular, a-
mong the hot Springs are the *Caroline*, and those
of *Aix la Chapelle*; and among the cold ones,
those of *Egra, Sedlitz, and Ratzeburg*. If serous
Humours are to be carried off by Urine, the
Seltz and *Embsene Waters* answer this Inten-
tion. If weak *Viscera* want to be repaired and
strengthened, the *Pyrmont Waters* do it effectual-
ly. If gross and viscid Humours are to be dis-
charged, and the obstructed *Viscera* to be relie-
ved; if weak Fibres require to be strengthened,
and the Kidneys and Bladder to be freed from
their stony Matter, the *Antonian, Wildung*
H and

and *Spaw Waters* are sovereign for these Purposes. If saline, sharp, and tartareous Juices, which cause the Gout and Rheumatism, require to be diluted and corrected, and the nervous Parts of the Body to be innocently relaxed and set to Rights, the pure *Waters* of *Schlangenbad*, *Seltz*, &c. assist in the most effectual manner, especially if mixt with Milk. Lastly, if corrosive, bilious Humours are to be rendered mild and temperate, and the weakened Tone of the Stomach and Intestines to be restored, the *Steel Waters*, in these Cases, are of eminent Service *.

99. The external Use of *Mineral Springs* is no less suitable to the various Disorders of the Body and its Parts. Thus, for Instance, when the Fibres of the external Parts are too dry, hard and crispy; bathing in the *Toplitz*, *Embsene*, *Piperine* or *Schlangenbad Springs*, relax, soften and render them pliable, better than any other Means hitherto known. Again, if the external Parts are too weak, slack and moist, the *Steel Waters* powerfully brace them up, dry, strengthen and confirm them. To conclude, when Swellings are to be dissolved, viscous and sluggish Humours to be dispersed or dried up, Blemishes and Foulness of the Skin, whether in the Form of Scab, Tetter or Ulcer, to be removed, the *Caroline* and *Aix la Chapelle Baths* are excellent.

The Conduct observed in these Enquiries.

100. Thro' the whole Course of our Enquiries into the Principles, Natures and Uses of Medicinal

* Hence it should seem, that Nature has done for us all that Physicians aim at by their Dispensatories, and Collections of Receipts; viz. supplied us with a Set of easy, cheap, serviceable and safe Remedies; ready prepared to our Hands; in such a manner as the present Pharmacy cannot rival.

Medicinal Springs, we have purposely avoided a large Apparatus of chemical and philosophical Experiments; and contented our selves only with a few, that are easy, simple and conclusive: Thus avoiding an Ostentation which many have run into, and multiplied Experiments to no Purpose; for 'tis Labour lost to examine these *Waters* by mixing them with common Salt, Nitre, Vitriol, Alum, Copper, Brimstone, Orpiment, and numerous other mineral Bodies; since no such Experiments can manifest to the Senses any other Principles than what we have in our simple Method discovered; as will be evident to such as are well versed in natural and Experimental Enquiries*.

101. For the same Reasons we have purposely omitted the *hydrostatical Trials* of such as, by the Means of *Water-Poises* or *Hygrometers*, examine the *specific Gravities of Liquors*: For tho' it might, at first, seem probable, that the Weight of *Mineral Waters* is thus discoverable, as it is in *Wine*, *Malt-Liquors*, *Urine*, *common Water*, and *Lixiviums*; yet whoever attentively considers it, will find this kind of Experiments very fallacious in *Mineral Waters*. For it appears by repeated Observation, that the *Hygrometer* plunged into these *Mineral Waters*, when taken first from the Spring-head, floats high, and shews their Gravity much greater than it is; and that when, the Day following, it comes to be plunged into the same Parcel of *Water*, it sinks lower, and makes the *Water* seem lighter.

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* Those who desire farther Light in this Particular, may consult Mr. Boyle on Colours, and *Mineral Waters*; and Dr. Hiern's Appendix to his *Acta & Tentamina Chymica*; where he treats of Colours and Precipitations. Edit. Holmiae, 1712. Pag. 140, &c.

And as no one, that we know of, had before taken notice of this Phænomenon, we examined into the Cause thereof; and found it owing to the Presence or Absence of the *subtile, expansive, aerial Principle*, that plentifully abounds in these *Waters*, when fresh taken from the Spring, and buoys up the Instrument, as if it were so much Air striving to get out, and rising in Bubbles: But after this Spirit is exhaled, the Instrument no longer meets with the same Resistance, which kept it from its due Station; and therefore sinks down deeper. Whence it appears, that the *elastic Power of Bodies* may pass for Gravity; or that the Powers of Elasticity and Gravity are equal.

102. Neither does the *hydrostatical Balance* determine the precise Gravity of *Mineral Waters*, or the exact Quantity of their Contents, if we wait till this subtile elastic Principle is exhaled; for then the *Waters* commonly become turbid, and the okery Parts fall to the Bottom: whence their true Gravity cannot be assigned. Much less can the *Hygrometer* examine the Gravity of *Hot-Well Waters*; because all Waters rarify, and become lighter with Heat: insomuch that if the Instrument be plunged into the *Waters* while hot, they seem to be extremely heavy, by making the Instrument float higher; but much lighter when cold, by suffering it to sink lower*.

* The most exact, or least exceptionable way of determining the *Specific Gravities* of *Mineral Waters*, is, perhaps, that of Mr. Boyle and M. Homberg, by carefully weighing them with a curious Balance in a Vial, with a long and slender graduated Stem; against an equal Vial, filled to the same height with *distilled Water*: or if two such Vials cannot be procured, by weighing the *Mineral Water*, and the *distilled Water*, at two Operations, in the same Vial, furnished with its graduated Stem.

S E C T.

S E C T. III.

*The OBJECTIONS to MINERAL WATERS
considered: and RULES laid down for ren-
dering such WATERS safe, and effectual, in
the Cure of Diseases.*

I. **T**H O' the Virtues of *Medicinal Waters* General
are great, and their use extensive; yet Directions
they have this in common with all other Me- for the Use
dicines, that their good Effects depend upon of Mine-
a proper Administration. To administer them ral Wa-
properly, requires a Knowledge of the Cir- ters.
cumstances both of the Patient and Distemper;
so as judicially to suit them in every Case.
And after understanding the Distemper, its
Causes, and the State of the Patient, there is
nothing more necessary than a thorough Ac-
quaintance with the Faculties and Virtues of
Medicinal Waters, and the manner wherein
they operate. The Sum of this Knowledge
not only directs to the Choice of such *Waters*
as are best appropriated to the Distemper; but
likewise so disposes and regulates their Use,
that the desired Effect must necessarily follow.
On the contrary, if these Particulars are dis-
regarded, no wonder if they who rashly ad-
vise the Use of *Waters*, should thereby injure
their Patients, unless by Accident. And yet 'tis
certain, that these *Waters* are but as an *Idol*
to many Physicians; or a Thing whereof they,
without sufficient Ground, believe and relate
numerous idle Fables. Many, in this Parti-
cular, are guided by a childish Superstition;
and apprehend great Danger from the Use of
H 3 such

such *Waters*; so that they prescribe them only in desperate Cases, or as a last Remedy, in *reputed incurable Diseases*. But my Experience of them, in a Course of many Years Practice, besides the particular *Experiments* I have used to examine them, have convinced me, that these Apprehensions are groundless; that such *Waters* are, at the same time, the most efficacious and most innocent of all the Medicines hitherto discovered; and that they never fail of Success, where the Physician knows how to apply them seasonably, and in the true manner. I will, therefore, here deliver what I have observed upon the imprudent and unskilful Use of these *Waters*; the happy Effects I have observed upon the true way of employing them; and the necessary *Rules* and *Cautions* for the Direction of others; that none, if possible, may hereafter complain they have used this excellent *Gift of Nature* to their Prejudice, or in vain.

That the
ways of
examining
Waters
are not
fallacious.

2. In order to strike at the Root of the Errors, which still prevail to the Discredit of *Mineral Waters*, we must here re-touch the *Ingredients* whereof they consist; and by means whereof they act. There are some who suspect most of the ways of trying and examining the Nature of these *Waters* as uncertain or fallacious: And it must be acknowledged, that there is no *absolutely perfect Method* of determining their precise Contents; by reason of the numberless Bodies they wash in the Bowels of the Earth. But on the other Hand, no one that understands the true *philosophical and chemical way* of enquiring into *Waters*, will deny, that tho' we cannot precisely determine every Ingredient they may possibly contain; yet we may certainly discover and demonstrate the principal ones; and those, whereon their Operations

rations and Effects depend. But let it be here observed, that whoever thinks to gain any real Knowledge in this Subject by consulting the Writings of the Ancients, will find himself greatly disappointed; and receive nothing for his Labour, but an absurd Collection of *imaginary Principles*. And yet 'tis surprizing, that even in the present Age, when such a great Light of Natural Philosophy is set up, there should be some, who, thro' a Veneration of Antiquity, a Love of Contradiction, or I know not what other Reason, obstinately cleave to the Opinions of the *Ancients*.

3. 'Tis a prevailing Notion, at present, among most of the Writers upon *Mineral Waters*, that they contain a *Vitriol*, like to the *common Vitriol* of Iron: which is the Opinion of the better, or more experimental kind of Writers. And in order to countenance this Opinion, they laboriously endeavour to prove, that *Mineral Waters* exhibit the same Phænomena as a *Solution of that Vitriol* in common Water. The Experiments they produce, on this occasion, are these. (1.) That *Mineral Waters*, and common Water, impregnated with *Vitriol*, have nearly the same Taste. (2.) That both of them turn purple, upon a small addition of *Galls*. (3.) That both of them turn to a kind of *Ink*, with a larger addition of *Galls*. (4.) That neither of them will curdle *Milk*. (5.) That both of them grow thick with *Oil of Tartar*, and let fall a Sediment. (6.) That the *Earth* they both afford, upon Evaporation, as also the okery Sediment they spontaneously let fall, makes a considerable Ebullition with *Spirit of Nitre*, and sends out a Smoke, in the same manner as the *Vitriol of Iron* would do, in the like Case. (7.) And lastly,

The Arguments for Vitriol in Waters confuted.

that the *Salt*, properly extracted from the insipid *Earth*, has a pale Colour, an irregular Figure, and produces the same Effects as *Vitriol of Iron*. And, by these Arguments there are some who think they sufficiently prove the Existence of an actual *Vitriol* in *Mineral Waters*.

4. But this Opinion rests upon weak Pretensions; which need not all of them be separately considered, because they make nothing to the Proof of the Assertion: we shall therefore only consider the capital thing among them, which being overturn'd, the rest will fall of Course. No one, who uses his Senses, can possibly doubt, but there is *somewhat of a vitriolic Nature* found in *Mineral Waters*: for not only the Taste, but the Sight confirms it, by their turning inky with *Galls*, &c. But the single Question is, Whether this *vitriolic Matter* be the same with the gross corporeal *Vitriol* in common Use? which has hitherto been proved by no Arguments nor Experiments. For the *vitriolic Matter* in *Medicinal Waters*, is volatile*; but the *common Vitriol*, fixt: so that their

* This Volatility of the *Mineral Spirit* in *Steel Waters*, is confirmed by Experiments made on the *Waters* of *France*; especially those of *Forges*; which are said to lose it in four or five Days: whence, in them, it appears of a more fixed or *irony* Nature, than in several other *Waters* of the same kind. See *Histoire, de l'Acad. An. 1608. pag. 58.* But the *Waters* of *Passy*, in *France*, contain this volatile *Vitriolic*, or rather *Pyritical Spirit*, exceeding loosely; so that it flies off immediately upon their being taken from the Spring-head. See *Histoire, de l'Acad. Ann. 1701.* But the newly discovered *Steel Waters* of *Passy*, in *France*, are said, even after having stood ill stopped down for seven Months, to turn inky with *Galls*, as perfectly as at first: which shews the fixed Nature of their *irony Principle*. See *Histoire, de l'Acad. Ann. 1720. pag. 45.*

their Nature and Operations are entirely different. Thus 'tis evident by numerous Trials, that the addition of *Galls* to the *Waters* of *hot Mineral Springs*, causes but a very small change of Colour, unless the Water be fresh taken from the Spring-head: and when it has stood any time, exposed to the open Air, it no longer changes Colour at all. 'Tis true, that in the *brisk Waters of cold Springs*, this Tincture appears blacker: but here also, both the natural irony Taste immediately vanishes upon their being exposed to a gentle Heat, or the open Air: and then they strike a dusky Colour with *Galls* no longer. So that the strongest *Steel Waters*, even those of *Pyrmont*, when heated, or suffered to stand in the Air for twenty-four Hours, afford no Signs of a *vitriolic Nature*. Nor has any one of those who argue so earnestly for a *solid Vitriol* in *Steel Waters*, been able, by their utmost Endeavours, from a hundred Pints of these *Waters*, to extract and exhibit, to the Eye, a single Grain of *Vitriol*. For tho' *Helmont*, in his *fourth Paradox*, declares, that, by the Means of Distillation, he obtain'd a *Vitriol* from the *Spaw Waters*; yet this plainly appears to be one of his Pretences: as no other Person, by the same Operation, tho' ever so exactly perform'd, could obtain an *actual Vitriol* from them *. The Conclusion

* It is very easy for a Chemist to fall into this Error, without having directly made the Experiment; for as all such *Waters* give evident Signs of their containing *Iron*, and were firmly believed of an *acid Nature*; the Conclusion, by bare reasoning, is, that they would afford a *Vitriol* by this Treatment. But such kind of Reasoning should never be trusted. The only way is for *Experiments* to judge of Things, and the sense to judge of *Experiments*. See *Helmont's* Notion on this Head refuted

sion upon the whole is, that these kind of *Waters* really contain somewhat of an *irony Nature* *; which being joined with a sulphureous Spirit, resembles *common Vitriol* only, in the Taste and the Colour it gives, without any farther approaching to the Nature thereof: And consequently that they err, who, upon hearing the Name of *Vitriol* mentioned about these *Waters*, judge of them, and cry them down, as abounding with the gross or *common Vitriol* of the *Shops* †.

5. There

refuted by Dr. *Lifter de Fontib. Medicat. Anglia Exercit. prim. Cap. 6. pag. 40, 41.* And even supposing an *acid Spirit* in *Steel Waters*, yet their *irony Principle* is not held dissolved thereby, as *Iron* is an *acid Menstruum*; which detains the *Iron*: whereas the *Steel Waters* soon let it fall, in Form of *Oker*, to the Bottom; and cannot, even by Heat, be made to take it up again.

* There is an Observation of M. *Lemery* which adds farther Light to this Matter. He found by Experiment that a *Solution of Vitriol* immediately turns black upon the *Tincture of Galls*, and that *iron Filings* turn black much slower with the same *Tincture*; whence 'tis concluded, that the *Forges Waters*, in *France*, are not *vitriolic*, but *irony*; because they turn black, not immediately, but after some time, with the *Tincture of Galls*. See *Histoire*. for the Years 1707 and 1708.

† The Author very justly accuses many Writers upon *Mineral Springs*, with feigning a real *Vitriol* in *Steel Waters*. The Errors of these Writers are principally owing to a want of Knowledge in *Chemistry*; and accordingly, when Persons well versed in that Art, such as Mr. *Boyle*, Dr. *Lifter* and Dr. *Slare*, come to treat of this Subject, they find no actual *Vitriol* in *Mineral Waters*. And whoever desires to see this Point dextrously clear'd up, may consult the *fifth Chapter* of Dr. *Lifter's* first *Exercitatio de Fontibus Medicatis Anglia*; where he shews the Origin, or slow Germination of *Vitriol*, and the *Calcarious Nitre*: and in the seventh Chapter of the same Work, where he shews, that perfect *Vitriol* is seldom or never contained in *Mineral Waters*; but that the *Pyrites* is totally soluble therein. We find indeed, in the Philosophical

3. There is another *Error* deeply fixt in the Minds of Physicians, as if *Mineral Waters*, especially those of the cold brisk kind, contain'd an *acid Salt*; as their common Name *Acidulæ* seems to imply: and, according to this Notion, their Virtues have been theoretically judg'd of, without Practice. This was the constant Opinion of the Writers upon this Subject, except *Giurius*, who, in the Year 1667, published a Treatise at *Paris*, with this Title: *The Secret of the Acidulæ newly discovered, in which the common Opinion of the Acidity of Mineral Waters is overthrown*. But the Book itself no-way answers to its Title; but is full of Vanity; and promises more than it performs. There have indeed been some who allow'd of an *alkaline Salt* in *Hot-Well Waters*; but no one before my self, experimentally prov'd it true of the *Acidulæ*, or brisk and cold Springs. For tho' *Henricus ab Heer*, in his Account of the *Spaw Water*, expressly declares, that not only those, but most of the *Acidulæ*, in *Germany*, made an Ebullition, and yielded a warm Fume, upon mixing with Wine; at the same time diffusing a grateful Odour, and throwing up numerous Bubbles, to a considerable Height; yet this Author never suspected they abounded with an *alkaline Principle*, but declared himself for their containing an *Acid*.

We

phical Transactions, N^o. 245, an account of a *Mineral Water*, at *Eglingham* in *Northumberland*, that yielded a real and genuine *Vitriol*. But upon Examination, the *Vitriol* was found owing to the Waters running over the marcasite Bed, that had lain for some time exposed to the Air. For *Marcasites* yield no *Vitriol* whilst covered with Water; or without being exposed to the Weather. And *du Clos* assures us, that in all those *Mineral Waters* of *France*, examined before the *Royal Academy* at *Paris*, there appeared neither *Alum* nor *Vitriol*.

We have, in the preceding Pages, so fully proved the contrary of this Opinion, or the actual Existence of an *alkaline Principle* in these *brisk Mineral Springs*, that it is needless to dwell longer upon it here. And the same we have also done with regard to their fine *Mineral Elastic Spirit*, whereon their Virtues have a great Dependence.

*That mere
Water is
medicinal.*

6. We next proceed to consider the various Virtues of *Mineral Waters*, when used internally. And here we lay it down as certain, that their Virtues are greater and more numerous, than those of any other Remedy, however specious or highly commended. A Knowledge of which Truth has given occasion to a considerable Error; for hence many have presently ascribed the particular Virtues of these *Waters* to the Ingredients they contained; without allowing any thing considerable to the pure *Water*, or Vehicle, wherein the more medicinal Parts resided. But when, upon full Examination, I found, that neither the pure *alkaline*, or *neutral Salts*, nor the fine, *elastic Spirit*, with which these *Waters* are impregnated, were able to produce such Effects, or work such Cures, separate from the *Waters* that contained them; I discovered that the Efficacy of *Mineral Waters*, both in preventing and curing Diseases, was in great measure owing to the *Water* itself; and that the other Principles served only to quicken or stimulate its Operation. And this will appear more manifest from an exact Knowledge of the Laws of Circulation, Secretion, and Excretion in the human Body. For as all the Juices of the Body require to be in a continued Motion; and as they necessarily consist of a large Proportion of an aqueous Fluid; 'tis agreeable to Reason and
Expe-

Experience, that there is nothing in Nature which approaches nearer, or is more agreeable to them, than *Water*. And accordingly there are several Instances of such, as by a daily Use of *Water* for their common Drink, have prolonged their Lives to a great Age; and relieved themselves from stubborn Distempers. And no wonder; since *Water* is a Fluid capable of preserving all the Juices, and all the Offices of the Body, in their proper or natural State; preventing the more subtile, earthy, saline and sulphureous Particles, lodged in the Juices, from introducing Putrefaction or Corruption; and capable of thinning and dissolving all the viscid, clammy or tenacious Humours, that are apt to clog and obstruct the finer Vessels. In short, *Water* is that Fluid which assists and promotes all the Excretions, by Stool, by Urine, by Sweat, and other Out-lets; so as to discharge and wash away all the Matters prejudicial to the Body*.

7. What adds a Confirmation to our Proposition, is, that there are numerous *Springs* which afford no sensible Mark of containing a truly saline or mineral Principle, and yet have medicinal and curative Virtues; which cannot, therefore, be justly attributed to any thing so much as the Purity, Thinness, and Lightness of the *Water* itself. But then, as *pure Water* can have no considerable Effect, unless drank in a large Quantity; since when taken in a small one, it often proves more pernicious than serviceable; and since to drink it in great Plenty, might easily overburden Nature, or prove too much for the Power of the Body to dispense

* See this Matter farther prosecuted, *Seet. V.* where *Water* is considered as an *universal Medicine*.

dispense with, and thus produce Stagnations, Extravasations, &c. to prevent these Inconveniences, nothing can appear more proper than to quicken such *Water* with some saline, and active Matter: for such a Matter will not only stimulate the moving Fibres of the Body, and accelerate their Motion; but also help to dissolve any gross or viscid Humours, adhering to the Sides of the Vessels, and obstructing the Circulation of the Juices. Hence 'tis manifest, that the additional Efficacy of *Mineral Springs* is considerably owing to such saline, active and spirituous Principles as naturally enter their Composition. Tho' we should not attribute more to them, than they deserve, or may, by Experiment, be demonstrated to perform.

*An Error
from a Chemical
Analysis of
Mineral
Waters.*

8. From the same false Notion of the Effects of *Mineral Waters* has proceeded another considerable *Error*: for there are many, even among Physicians, who conceive that the Wholesomeness and Virtues of these *Waters* can be no way so well judged of, as by the large Quantity of Ingredients they afford upon Evaporation: without considering that the *Fire* is no trusty Operator in this Case. For by means hereof only the more fixed Principles of the *Waters* are made manifest; and not their subtile ones, whereon 'tis certain that a part of their Virtue depends. Thus the terrestrial, chalky Matter wherewith many *Waters* are loaded, rather hinders than promotes their desired Effect; especially when their Heat and spirituous Principle has left them. Whence the *Waters* of such hot Springs coming to cool, and stand for some time in the Air, if they are afterwards drank, they occasion many Disorders, and pass not so readily,

as when drank fresh from the Spring-head. And of this we have a remarkable Instance in the two *Caroline Springs* formerly mentioned.

9. Since therefore Physicians themselves have run into great Errors, with regard to the Principles and Powers of *Mineral Waters*; it is the less to be wondered, that from such false and theoretical Notions, several absurd and pernicious Opinions should have spread, concerning the Use of these *Waters*. These *Opinions* we come now to examine, after having thus prepared the way. There are many who pass their Censure upon *Mineral Waters* from hear-say, without having ever visited the *Wells* themselves, or been Eye-Witnesses of their Effects; hence, after the common manner of Men, they fancied numberless noxious Ingredients in them, and boldly ventured to declare them a kind of violent, dangerous Remedy; which they currently stigmatize with the name of a *Horse Medicine*; as a thing unfit to be used in any but robust Constitutions. But as great Authority as this Notion stalks about with, we shall make it plainly appear to be directly opposite both to Reason and Experience. And I would willingly know who can pretend that *pure Water* is a violent Medicine? For certainly there is nothing in Nature more safe or innocent. I would next ask, what Medicine the whole Art of Physick affords more safe than *Salts*; especially those of the neutral or alkaline Kind? What is more mild or gentle, and indeed more serviceable in weak Habits, than a subtile, astringent, or irony Earth, mixt with a kindly *Salt*, and kept dissolved in the lightest and purest *Water*? In the last place, I demand what can possibly add greater Strength to the
Body,

That Waters are no violent Medicine.

Body, than a subtile, insipid, spirituous *Fluid*? And yet these are the active Principles, which being kindly mixt in *Medicinal Waters*, give them all their Virtue. And hence they are so far from violent, that all their Operations are performed agreeably, and without Disturbance; so as when they purge, or vomit, to occasion no loss of Strength, no loss of Appetite, no Sickness; even when they work in their powerfulest Manner; but rather raise the Appetite, strengthen the Stomach, and recruit the Spirits. When they pass by Urine, they occasion no Strangury or Sharpness; but go off with a degree of Pleasure. When they operate by Sweat, they do it without occasioning any Faintness, or other Disorder. Nay, we have seen Persons of both Sexes, of the tenderest Constitutions, and labouring under Fevers, Bleedings, &c. Women newly delivered, and brought to the weakest State, undauntedly drink the *hot Caroline Waters*, without the least Disadvantage; but on the contrary, these *Waters* excellently promoted all the Secretions, strengthened the Faculties, and finished a Cure. And so innocent are these *Waters*, that Children and Women with Child may use them with Safety and Advantage: and Persons of delicate and tender Constitutions find them to operate with more Ease, than the robust; and need employ them but in a moderate Dose. It must however be allowed, that the drinking of these *hot Caroline Waters*, which are not of an agreeable Taste, in so large a Quantity as that of ten or twelve Quarts a Day, or in the Compass of a few Hours, is nauseous and disagreeable, especially to those unaccustom'd to it; but from hence to call this a *Horfe Medicine*, is arguing
very

very unfairly and inconclusively ; for 'tis no true Logick that would prove the Violence of these *Waters*, from the Largeness of their Dose. *

9. But tho' *Mineral Waters*, with regard to their Nature and Virtue, are an extremely safe and gentle Remedy ; yet it frequently happens, by the ignorant Advice of Physicians, that they become a *Horse Medicine* with a Witness. For it is the preposterous Custom of some, either upon the Day the Patient begins his Course, or the Day before, to *prepare his Body for the Waters*, as they call it, by giving him some violent Purge. Surely whoever considers this absurd Procedure, will find it prejudicial almost beyond Repair. For such is the Nature of the stronger Purgatives of the Shops, as *Coloquintida*, *Rosin of Jalap*, *Scammony*, *Elaterium*, *Gamboge*, &c. that by the virulent and caustic Principle whereon their Action depends, they may entirely pervert or destroy the Tone and Strength of the Stomach and Intestines ; and invert their natural peristaltic Motion, by the immediate Contact they have with those Parts. And how unreasonable this may prove, is manifest from hence ; that nothing is more requisite towards securing the desired Effect of the Waters, than an unim-

The Preparation requisite for drinking the Waters, in respect of Purgings.

* The drinking of *Mineral Waters* in such immoderate Quantities seems the peculiar Custom of *Germany*, and not adviseable but upon extraordinary Occasions. We find in *England*, that two Quarts of the *Bath Water* is esteemed a large Proportion ; and the general Stint is a Quart or three Pints. A Flask of the *Spaw* or *Pymont Waters*, drank at several Draughts, is with us a considerable Dose ; and four or five half Pint Glasses of the new *Tunbridge Wells* at *Islington*, a Quantity generally sufficient.

paired and entire Motion and Tone of these Parts. But the Use of such virulent and rough Purges is much more dangerous, and fatal, to those who are entering upon a Course of *cold Waters*; by which, all the Mischiefs brought upon them, from such Purges, are rather increased, than removed, thro' the Coldness of the *Water*: whereas the *hot Waters*, by their Heat, in some degree help to moderate these Disorders, resolve the Contractions, and restore the inverted Motion. But the greatest Mischief which arises from this violent Purging, and renders its ill Effects observable to the Eye, is that in a Day or two after the first drinking of the *Waters*, they do not pass so readily, as they otherwise would, thro' all the Strainers and Outlets of the Body, by Reason of the Constriction which such Purges leaves behind them, in the intestinal Tube, and Parts adjacent; after the same manner, as daily Experience shews, that the Body is bound up, or rendered more coſtive, for several Days after the Use of violent Purges.

10. But as the Abuse of a Thing should by no means destroy its Use, we do not here condemn all Sorts of purging, by way of preparing the Body for a Course of *Waters*; but only those of the violent Kind; which have a pernicious Quality. Particularly 'tis necessary, in some Cases, before the Course, to take a gentle lenitive Purge, when the Intestines are clogged with a gross, viscid Matter; which might otherwise hinder the free Passage of the *Waters*, prevent their Effect, and bring on several Inconveniences. The same Caution is likewise to be used when *Bathing* alone is the thing intended; to prevent fresh Disorders, which, thro' such
an

an Omission, frequently happen, when Persons unwarily bathe in the hot *Caroline Springs*. But for this Purpose, choice should be made of such mild Purgatives as, without Disturbance, may cleanse the first Passages; viz. a Solution of *Manna* with *Cremor Tartar*, or half an Ounce of *Epsom Salt*, dissolved in half a Pint of *Water*, or a proper Quantity of any of the purging *Waters*; which may thus be taken to Advantage a Day or two before the Course is entered upon. But if the Body has long been costive, and the Excrements hardened in the Intestines, 'tis better to use an emollient Glyster or two, prepared of *Mallow-Leaves*, *Marsh-Mallow Roots*, or the like, boiled in *Water-Gruel*, or *Milk*; with the Addition of Oil and a little Salt. But for such whose Bodies are open, or have not the first Passages blocked by any large Collection of Humours, 'tis sufficient to dissolve in the first Glass of the *Waters*, about three Drams of the *Epsom Salt*; which wonderfully facilitates their Passage. Lastly, they who are sufficiently laxative already, require no Preparative at all.

11. That Error deserves no less to be censured, which leads Physicians, when the Course is over, to use violent *Catharticks* to purge off the Remains of the *Waters*; without a due Regard to Peoples Constitutions, or the Regimen necessary in this Case. 'Tis indeed certain, and confirmed by Observation, that when *Waters* have been freely drank, for a great length of Time, they are apt to collect and stagnate in various Parts of the Body, but particularly in the Folds of the Intestines; and that such stagnant Waters should not be suffered to remain there; but rather be

The Caution to be observed after drinking, with regard to Purgatives.

discharged.* This however is not to be done imprudently, or with Loss of Strength to the Body ; but by mild and gentle Means : whence 'tis the Business of a Physician to make choice of such Medicines for the Purpose, as best agree to the particular Constitution, Temper, and Strength of the Drinker. And upon this Foundation we do not absolutely reject the Use of the stronger Purges ; but prefer such as act by no virulent Principle, yet have Strength and Briskness sufficient to perform the Work. And of this Kind are principally Manna, in a large Dose, quickened with any of the *purging Salts*, *Extract of Rhubarb*, or *Extract of Aloes* : all which being very easily dissolved by the Fluids of the Intestines, act briskly, without sticking to the Coats thereof, without vellicating them, or occasioning violent Gripings, Inflammations, &c. as *Rosin of Jalap*, *Scammony*, and *Gamboge*, too often do ; especially when given alone, or without their proper Correctives. But if any one is strongly attached

* Riding on Horseback, or other proper Motion and Exercise, seems a good Expedient to prevent this ill Effect ; and might therefore perhaps be properly used, at least after, if not during a Course of the Waters. But Dr. Stare is of Opinion that the Waters pass best, if the Persons who drink them sit still, lye in Bed, or on the Couch. See *Philosoph. Transact.* N^o 351. This appears just, with regard to their passing by Urine ; but that not being the only way wherein such Waters act ; and it being necessary in some Cases that they should also find their way thro' the Strainers of the Skin, and all the excretory Ducts ; gentle Motion and Exercise may be serviceable to that general Intention of the Waters ; the making of them pass indifferently thro' all the Canals of the Body. But the Observations and Reasoning of Dr. Stare upon this Head, deserve to be farther considered ; especially as enforced in his Account of the *Pymont Waters*, printed at London 1717.

attached to the use of these violent Purgatives, as thinking them more efficacious, let them by all means be given in a small Dose, and along with a Dram or two of the *Epsom*, or other *neutral Salt*, to quicken their Operation and carry them off. For 'tis now a thing well known, how much these kind of *Salts* increase the Efficacy of the resinous *Catharticks*: insomuch that a single Grain of *Scammony*, or *Rosin of Jalap*, when mixed along with ten or fifteen Grains of a *neutral purging Salt*, shall operate better than six Grains of such a resinous Substance taken alone: and this with greater Ease and Safety. But where a Person has naturally a robust and strong Stomach, or intestinal Tube, wherein there remains a large Quantity of the stagnant *Waters*; then, without Dispute, a stronger Purgative is proper; and may be safely given, if the due Regimen be observed; that is, if the Body be well defended from all cold, the Patient keeps in a warm Room, and both a little before and after the Operation, drinks emollient Broths, Water-Gruel, or the like, in order to defend the Stomach and Bowels from the corrosive Acrimony that might otherwise prove pernicious.

12. There is still another Error committed by Physicians, with regard to Purgatives, in the Case of *Mineral Waters*: for most of them prescribe but one Kind, in all Cases and Constitutions; as if Nature had framed all Bodies to be relieved by one and the same Medicine. Whereas 'tis certain, that to render Purgatives successful, they must be suited to the particular Constitution, Age, Sex and Disorder. Thus for such as have the Tone or natural Tensivity of the Stomach and Intestines destroyed; such as are subject to Diarrhœas,

Women with Child, Women who have lately lain in, &c. the proper Purgative is *Rhubarb*. Where the Humours are sharp and acrimonious ; where the Body is subject to the Gout, Rheumatism or hypochondriacal Disorder ; Manna and the *neutral, purgative Salts* are best. Where the Bile overflows ; in order to lessen its Quantity, and take off its Heat, there is nothing better than Tamarinds. But to invert this Order, and give the contrary Medicines in the same Cases, must needs produce different Effects.

13. There is a Question often started, to the Perplexity both of the Physician and the Patient, *viz.* Whether it be always necessary, after a Course of the *Waters*, to take a Purgative, before entering upon *Bathing* ? To which we answer, That 'tis not always necessary : for if the *Waters* have passed off kindly, without leaving any Signs of Stagnation behind them, either in the Feet, or Habit of the Body, and especially if the Cure be used only as preservative ; there is no Necessity for fatiguing the Stomach, and whole Body, with repeated purging. And to speak a plain Truth on this Occasion, the Physicians have rather an Eye to their Fees, than the Health of their Patients, in advising it. But the Case is quite otherwise when the *Waters* are not discharged in Proportion as they are drank, but actually remain behind in the Body ; or when the Stomach of hypochondriacal Persons is loaded with a Collection of viscid and acid Matter, from a want of Digestion : in these Circumstances purging must be recommended ; unless we mean to expose the Patient to greater Danger by the Use of the *Bath*. But here also the Purges should be of the mild and gentle Kind, such as *Epsom*

som Salt, Manna, Pilulæ Rufæ, Extractum Rudi, or the like.

14. Having thus settled the Matter of *Purging*; we proceed to the Consideration of *Bleeding*, with regard to its Service or Difference in the Case of *Mineral Waters*. There are still remaining amongst us many Physicians, who following *Erisistratus, Helmont,* and others of that Kind, pronounce from Authority, without Proof, that “ Bleeding is a “ Remedy, of all others the most disposed “ to let out the Treasure of Life; and draw “ away the Receptacle of the Soul; ” and therefore at once banish it the Kingdom of Physick. We shall not here enter into an Examination of this Opinion; but shew that Bleeding is often proper in order to receive Benefit from drinking the *Waters*, and sometimes highly necessary; so as not to be omitted without the greatest Danger. We do not however indiscriminately advise it to all Persons, but only to such as are too full of Blood and Juices; and particularly in the Case of Women, whose menstrual Discharges are stopt, either thro’ Pregnancy or some Distemper; and to those Men who are subject to an hæmorrhoidal Flux, and find it stopped; again, to such whose Vessels, thro’ the whole Habit of the Body, are full and turgid; and lastly to those accustomed to high living and a plentiful Use of Wine, or have a florid Complexion and a full corpulent Habit.

15. That the natural *Fluids* may readily pass thro’ all the Canals of the Body, ’tis necessary that the Vessels should not be overfill’d with Blood. Thus we plainly find by Experience, that in a full and florid Habit of Body, the Pulse beats low, and the Excre-

tions move languidly ; but as soon as a Quantity of Blood is taken away, the Pulse beats freer and stronger, and all the Secretions go on to better Advantage. If therefore whilst the Body remains full of its own Blood and Juices, the *Waters* should be drank in a large Quantity ; they would not only move slower thro' the Vessels, but also stagnate and corrupt : and by Reason of this large additional Quantity, they may drive the Blood forcibly upon the more noble Parts ; and thus produce Inflammations, Hæmorrhages, Obstructions in the *Viscera*, and many other Mischiefs : insomuch that Persons of this Habit of Body, coming directly to drink the Waters, without taking away some Blood, run great Risques of their Lives. On the other hand, Persons who bleed a Day or two before they enter upon this Course, have none of these Dangers to fear ; but may drink the Waters with the desired Success : as is well known to those who have prudently observed the Effects of *Mineral Waters*. For 'tis a common Observation at the *Wells*, that Persons who found themselves ill upon first drinking the Waters, on Account of their not passing off regularly, but oppressing and incommoding the Body, so far as to determine them to quit their Design ; yet having, by the Advice of another Physician, lost a little Blood, they have not only been soon relieved from their Disorders, but entered upon their Course again to great Advantage.

*Objection
to the
drinking of
cold Wa-
ters an-
swer'd.*

16. There are several Physicians who scruple prescribing the Use of *cold Waters* to such as have weak Nerves, for fear of weakening them still farther. It must indeed be acknowledged, and Experience manifests, that the
most

most dangerous Symptoms are frequently produced in the Body from external cold ; and that this happens in a much greater degree when the Cold reaches to the internal Parts, which are unaccustom'd to bear it. Thus we have Instances where the whole Body being suddenly cooled, has occasioned loss of Sight, and a Trembling of all the Limbs ; where the Administration of a *cold Glyster* has caused immediate Death ; with other Instances to the like Purposes. But, for these Reasons, totally to reject the Use of *cold Mineral Waters* betrays great Weakness and Ignorance. All that they justly indicate is, if the drinking of such Waters *cold* occasions any bad Symptom, the drinking of them *cold* is to be forbid ; and a Method of drinking them advised, which shall render the Water suitable to the weak State of the Body. And this I have for a long time very advantageously done, by directing the Bottles of the *Water* to be plunged in *Balneo Mariæ*, till they receive a degree of Heat more agreeable to the Body and the Palate ; a fine Hole being first made with a Needle in the Cork, to prevent the elastic Spirit, thus expanded by the Heat, from evaporating ; and keep the Bottles from bursting. Nor let it be apprehended, that this Treatment of the Waters causes an entire loss of the *Mineral Spirit*, whereon their Efficacy depends ; for as the Heat is not great, and as a proper Caution is here used, a sufficient Quantity of the Spirit is still kept in. And tho' there be no need of farther Arguments, since Matter of Fact confirms the Truth hereof ; yet we find that even the *Waters* of the *botlest Springs*, whose Heat is much greater than that
here

here recommended, are not entirely destitute of this *volatile, mineral Principle*.

17. Having thus given the necessary Cautions and Directions, as well to Physicians as the Patients, with regard to entering upon a Course of the *Waters*; we now proceed to consider in what Distempers they are of more eminent Service than any other Remedy. But as the Catalogue of these Distempers is extremely large; we shall only speak to those wherein most Physicians rather think the *Waters* detrimental than advantageous; and shew the Erroneousness of this Opinion, both from Reason and Experience.

*Distempers
wherein
Waters,
contrary to
the common
Opinion,
are ser-
viceable.*

18. And first, the Use of *Mineral Waters* is held dangerous in *violent Fluxes of the Menfes* and *Hæmorrhoids*. The Reason upon which Physicians proceed in forbidding *Waters* in these Cases, depends upon a false Notion of the Causes of such Discharges, and of the Ingredients of the Waters; which they take to be Metallic, Vitriolic, and Styptic: and having found by Experience that Astringents are very prejudicial in such Cases, they hence forbid both the Use of hot and cold Waters therein. But as a Knowledge of the Blood's Circulation discovers the true Cause of these Discharges; and as the Apprehension of styptic Ingredients in *Mineral Waters* is groundless; this Opinion of theirs must be rejected as idle and frivolous. A careful Enquiry into the Cause of violent *Hæmorrhages*, shews it to be no other than an Obstruction to the free Circulation of the Blood in certain Parts of the Body. And thus the Blood having not its due Motion thro' the Canals, impacted Matters are of Consequence generated in the *Viscera*, and the Obstructions

structions necessarily rendered greater : whence the Blood coming to these obstructed Parts, in a still greater Quantity, and finding no Passage, of course diverts, and breaks its way thro' other Parts, where it has either been accustomed to find vent, or meets with the least Resistance : whence it comes to be discharged with Violence in the Parts above-mentioned *. The first rational Intention therefore in the Cure of these Disorders, is to open the Obstructions of the *Viscera* ; and to restore a free Circulation of the Blood therein. And this can no other way be so effectually done, as by the drinking of *Waters*, impregnated with a gentle stimulating *Salt*. For 'tis the Property of these *Waters*, by the large Quantity of their aqueous Part, to dilute and thin the stagnating Humours, and render them fit for Motion ; whilst by their saline Particles they dissolve the Viscidities, twitch and shake the Canals, and cause them to press, protrude and squeeze forwards their Contents. This appears to be the *Rationale* of the Case. And thus in Fact *Henricus ab Heer* † expressly declares, that “ The *Spaw Waters* are extremely well fitted for provoking the *Menses*, as “ appears by a thousand Instances ; and yet “ are more successful than any other Medicine in stopping too large a Flux thereof.”

19. But that the *Waters* may with the greater Certainty and Advantage have this Effect, proper Care must be taken that the Body
in

* There will now follow several *Instances* of the rational Method of discovering the Causes of Distempers, the Investigation of Remedies, and their right Application ; the three Things mentioned in the Introduction, as the Essentials of a *Physician*.

† In *Spadacren*. cap. 9. p. 83.

in such Circumstances be not charged with an immoderate Quantity thereof; but be drank in a small Dose, and not too hot. How necessary a due Regard to this Circumstance is, appears by an eminent Instance in the two *Caroline Springs*; where the Use of the most temperate of them, call'd the *Mill Spring*, has an admirable Effect in these Cases; whilst the common violently hot one, rather increases the Disorder. 'Tis also of great Importance, when the above-mentioned Fluxes are large, that both before, in, and after a *Course of the Waters*, all Aloetic and the stronger Purgatives be carefully avoided, which put the Blood into a violent Motion; and if any Purges become necessary, to use in their stead those that are gentle, and of a strengthening Virtue; such as *Epsom Salt*, *Rhubarb*, *Sena*, &c.

Suppression of the Menfes.

20. And as these *Waters* have an extraordinary Efficacy in the stopping of Hæmorrhages; their Virtue is no less considerable in a Suppression thereof. And this Truth can be questioned by none but such as have never attended at the *Wells*. For as a Stoppage of these natural and critical Discharges of the Blood, proceed entirely from an Obstruction, or spasmodic Contraction of the blood Vessels, thro' which it uses to run; *Mineral Waters* are wonderfully adapted to restore and promote these Discharges: it being the Property of such *Waters* to flow to the Extremities of the blood Vessels, and there soften, or attenuate the grosser Substances that block up the Passages, and force it away by the elastic Property of their aerial Spirit. And, at the same time, by the large Quantity of their pure aqueous part, they relax the harden'd and contracted Fibres; and thus again open the

the accustom'd Passage to the Blood. To confirm this reasoning, we shall here insert the *History* of an extraordinary Case, whercof ourselves were Witness; and chuse it as a singular Instance, out of a very large Number to the same Purpose.

A Person of Distinction, about fifty Years of Age, of a Constitution betwixt sanguine and bilious, long used to a Court-Life, Wine, and a high irregular Diet, was seized with the *Gout* and *hæmorrhoidal Flux*, returning at stated Periods; but without being much incommoded thereby, so long as he continued to open a Vein at proper Seasons. But being, a few Years ago, advised by some Physician or other, to leave off bleeding, under Pretence of growing in Years; and following this Direction, he was in the Summer-Season afflicted with a violent Colick, extreme Costiveness and Pain. His usual Physicians little suspecting the true Cause of the Distemper, ascribed it to the Gout struck inwards; and therefore rejected Bleeding as a perfectly useless or dangerous thing. Another Physician being call'd, and enquiring narrowly into the Cause of the Disorder, immediately order'd the Patient to have a Vein open'd in his Foot, and to use emollient Glysters. Upon this the Violence of his Pain was immediately lessened; and growing better by Degrees, he was carried, at the proper Season, to the *Caroline Waters*; by the internal and external Use whereof, he happily recovered the periodical Return of his *Hæmorrhoids* and *Gout*; and was perfectly cured of his Colick.

21. From too large Discharges of the Blood-Gonorr-
Vessels, we pass on to the immoderate ones of hæm.
the Lymphatics; the more common whereof are
the *Gonorrhœa* and *Gleet* in Men, and the *Fluor*
albus

albus in Women. With regard to Distempers of this kind, many Physicians imagine that *Mineral Waters* are improper. But *Henricus ab Heer*, in his time, clearly remarked the Falsity of this Opinion ; and declared that, how doubtful soever others might be in the Point, the *Spaw Waters* were certainly serviceable in the virulent *Gonorrhœa* ; and produces Instances of his own Knowledge to confirm it. * 'Tis however certain, that these kind of Fluxes are generally increased by the Use of *Mineral Waters* ; whence their Disrepute in such Cases seems to have proceeded. For whilst Physicians remain'd ignorant of the Causes of these Disorders, they attributed this Increase of the Flux to an Increase of the Distemper. But as the present Discoveries in *Anatomy* have given much better Light into the Seat and Nature of such Distempers, 'tis proper the Cures of them should be regulated accordingly. An obstinate *Gonorrhœa* or *Gleet* in Men, generally has its Rise from the unskilful Cure of a common *venereal Running* ; which corrodes the *Prostate Glands*, and others belonging to the Parts of Generation ; and renders them scirrhus and fistulous. An inveterate *Fluor albus* proceeds from an acrimonious Humour, generated by a too violent or frequent Use of Venery ; or from a Humour, introduced in the way of a communicated *Taint*, which afterwards infects the Glands of the *Vagina*, so as not only to make them discharge their Juice in plenty upon the adjacent Parts ; but the same Juice being also infected, eats and corrodes the fine Fibres of the Parts it passes over ; and thus occasions sharp darting Pains, Excoriations and *Ulcers* ; whence proceeds the Mat-
ter

* Spadacr. cap. 9. pag. 80.

ter of a *virulent Flux*. From this account, which is taken from Dissections, it clearly appears, that in order to wash away, dilute, and weaken these infected Juices, soften the hardened Glands, strengthen the Fibres that are fretted and corroded, and join them again with the other untainted Parts, a Course of *Mineral Waters* is highly proper. And tho' it be true, that whilst the Course is in hand, the Flux will increase, yet when the Course is over, there ensues a more certain and confirmed Cure. But in order to this end, *balsamic Remedies*, and a moderate Decoction of the *drying Woods*, are to be used in the drinking of them; by which means the Cure may be surprizingly facilitated.

22. And no less serviceable is a Course of *Glandular Mineral Waters*, towards the Cure of Distem- lar Dis-
pers seated in the Glands of the Body; whe- cases.
ther proceeding from Obstructions or Relaxations of the Glandular Parts. For such *Waters* have a very opening, diluting, resolving, absterfive and strengthening Quality. To gain the better Credit to this Assertion we shall here subjoin the History of a curious Case that happened lately.

A *Portuguese* Lady of a noble Family, requiring of her Physician a Purgative by way of Prevention, he officiously prescribed her an *Electuary*; upon the use whereof she soon fell into a violent Salivation, that continued for almost eight Months; till it had brought her to the extreme Weakness, and rendered her almost like a dead Carcass. The *Caroline Waters* were advised her; by the Use whereof, both internally and externally, with the Assistance of gentle Purgatives, at proper Intervals, she not only got rid of her spitting, but quickly

quickly recovered her former Strength, and Beauty. It was remarkable in this Lady's Case, that after her Cure was compleat, she, by sitting longer in the hot Bath than was directed, had nearly relapsed into her spitting: and doubtless would have done, if her Physician had not immediately prevented the Mischief by proper Purgatives.

*Diseases of
the Lungs.*

23. It is a current Opinion, that the drinking of *Mineral Waters* proves prejudicial to the *Lungs*, and increases all the Disorders thereof. The Origin of this Error is apparently owing to a false Notion of the Ingredients of these *Waters*; and an improper Advice of them to such Persons whose *Lungs* were already ulcerated and eat away: whence the Ignorance of Physicians has pronounced them prejudicial in pulmonic Disorders. It is manifest by Inspection, and the Anatomy of tabid Bodies, that most Distempers of the *Lungs* arise from an Obstruction and Hardness of the Glands, wherewith this part so plentifully abounds. Whence proceed inveterate Coughs, Phthysics, Difficulty of Respiration, Asthma's, &c. in all which Diseases, the primary and sole Intention should be to open and dissolve away the Obstructions and *Scirrhusities* in the *Lungs*, that cause the Distemper. And this can no other way be so readily effected, as by a Course of *Mineral Waters*. But to prevent their saline Acrimony, which is certainly unsuitable to the delicate spongy Substance of the *Lungs*, from doing any Mischief thereto, it is adviseable to mix the *Waters* with *Asses Milk*; which Experience shews is the best for this Purpose; or else with *Goat's Milk*. And to mix the *Waters* in this manner not only blunts and mollifies their saline Particles,

but

but also conduces to temper and sheath the Acrimony of the whole Mass of Blood ; so as to render them eminently serviceable in Diseases of the Lungs. We have seen numerous Instances of their good Effects, so drank in these Cases ; but shall here single out only a late one, for an Example.

A maiden Lady, about Twenty, naturally of a florid Habit, had lost her Complexion ; her menstrual Discharges were obstructed, and she was troubled with a Cough, especially Night and Morning. This Cough proved so violent, that it frequently occasioned her to vomit and bring up a little Phlegm, with the utmost Difficulty. She was coſtive all the time. But upon drinking the hot *Caroline Waters*, for three days, she grew sensibly better ; her Cough abated : and when her Course was ended, she returned perfectly cured.

24. What we have above said about the Diseases of the Lungs, may also be extended to the other *Viscera*, and Diseases of the lower Belly. The Writings, and common Discourses, of *Physicians* are full of the Mischiefs which they suppose *Mineral Waters* bring upon the *Viscera*. And indeed the Use of these *Waters* cannot be recommended where the *Viscera* are consumed, or highly tainted ; where the Humours are extravasated, on account of Vessels broke either in the *Thorax* or *Abdomen*, or where Impostumations are formed : to prescribe the drinking of the *Waters* in these Cases, is to increase the Disorder, and hasten Death. But this Restriction does not reach to all the Diseases of the *Viscera*. The greatest number of chronical Distempers, which come on slowly, and prove of long Continuance, proceed from an Obstruction in these Parts, and a Hindrance to

*Diseases of
the Viscera.*

the Circulation of the Blood : for the Prevention or Removal whereof, there is nothing more serviceable than *Mineral Waters* ; which preserve the *Viscera* in their natural State, and open Obstructions. Thus they are admirably preventive of the Scurvy, of the Asthma, of Abortion and Sterility, of the Dropsy, and the Stone ; curative of an ill Habit of Body, and lessen a present Fit, as well as repel an approaching Fit of the Gout. And all this is attested by Experience and Observation. Whence it clearly appears, how idle and childish that Fear is, which many Physicians indulge, of the pernicious Effects of these *Waters* : tho' it is true, they have always at hand certain ingenious Comparisons and *Instances of like Cases*, as they call them, which they use, on all Occasions, with a plausible Shew to the People. But whoever desires to see these Men painted to the Life, let him consult *Baglivi* ; who will tell him, that “ such popular Parallels are esteemed only by ignorant Physicians, who direct their Cures, not by any Rules of Reason, and Laws of Nature ; but rather by the Rules of some fictitious and incomplete Similitude or Resemblance *.”

Bathing in
the Hot-
Wells, to
what Dis-
tempers
suited.

25. Having thus considered the internal Use of *Mineral Waters*, we proceed to consider them in their external Uses ; so as to point out several *Errors* therein, whereby both the Sick and the Sound are frequently endangered. What a Variety of Mischiefs are occasioned by the imprudent Use of *Mineral Baths*, is the common Talk in all Places : but we meet with these Complaints no where oftner, than at the *Caroline Springs* ; which have this peculiar Virtue above all other
Hot-

* Bagliv. Prax. Lib. i. Cap. 6 §. 4.

Hot - Waters, that they do not soften the Body ; but rather, by reason of the copious earthy and astringent Matter they contain, bind up the Parts, strengthen those that are weak, block the Pores ; and thus produce a quite contrary Effect from other *hot Springs*. This Particular being not attended to by such Physicians, as without a due regard to the Distemper and Constitution, indiscriminately advise their Use, may produce infinite Mischiefs. In particular, these *Waters* are highly prejudicial to Persons of a delicate and tender Habit, where the Body is foul or affected with spasmodic Disorders ; such as the hypochondriac Melancholy, and the Colick ; where the Surface of the Body is broke out in Spots, where the Patients are afflicted with Diseases in the Joints, where the Menses or Hæmorrhoids are flowing, where Persons are subject to the Head-ach, Palpitations of the Heart, or labour under venereal Disorders, and in numerous other Cases, which are prudently guarded against by *Wedelius*, in these Words : “ The
 “ *hot Baths* are of Use where the Limbs are to
 “ be strengthened, where the Ligaments and
 “ Tendons are to be gently excited to Motion,
 “ and where the Body requires to be dried.
 “ But Care must be had to prevent their re-
 “ ducing the other Limbs to Extremity ;
 “ whilst, by drying too much, they deprive
 “ them of their Motion *.” Physicians and others have frequently been surprized to find, that tho’ every thing has answered to Expectation in a Course of drinking these *hot Waters* ; yet at length, when the Patient quits the *Bath*, he finds himself as bad as ever, or perhaps worse.

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* Amœnitat. Mat. Med. Lib. I. Sect. III. Cap. xi.

worse. But this unexpected Change is easily accounted for, from what we have above delivered. For during the time the Patient continues to drink, Bathing cannot excite those Disorders in the Body; because the internal Use of the *hot Water* resolves, and prevents these Constrictions, and other ill Accidents, produced by the *Bath*; and again expels and throws out of the Body that which was driven from the external to the internal Parts. But this is no longer the Case when the Patient ceases to drink.

26. What we have here said relates only to the violently hot *Caroline Spring Waters*, which contain a large Quantity of an astringent chalky Substance; whereas that other, called the *Mill Spring*, is a more pure and subtile *Water*, that may be used with much greater Safety. As therefore as the former is so dangerous, 'tis better for Physicians, who have not a true and exact Knowledge of its Power and Effect, nor understand how to direct and distinguish its Use, according to the different Circumstances of Cases, entirely to refrain from prescribing it; and recommend in its stead such *hot Waters* as are less powerful, but more safe. And a principal *Spring* of this kind is that of the *Toplitz*; which is deservedly famous for softening, relaxing and opening the external Parts of the Body. For, by a strict Examination, it clearly appears that these *Waters* contain scarce any *calcareous Matter*, at all; so as neither to conflict with *Acids*, nor turn turbid and precipitate with *Oil of Tartar*: but owe their Excellence to their particular Lightness and Purity. Whence they may safely and efficaciously be used for resolving and dissolving hard Tumours, for restoring contracted Limbs,

Limbs, and smoothing and relaxing a dry shrivelled Skin. Besides this, there are several other *Waters* of the same Virtue, that may for these Purposes be used with the utmost Safety; as not abounding with any earthy Principle; and containing nothing besides a light and pure *Water*.

27. There is likewise a great *Error* frequently committed in using the *Bath* too hot; which thus violently heating the Blood, disturbs and expands the Humours: whence no wonder, if this Procedure gives Palpitations of the Heart, a Pain in the Head, Weakness, Faintness, and a Sinking of the Spirits. This Mischief is also highly increased, if the Body be full of Blood and Juices, or turgid with ill Humours, upon entering a *hot Bath*; for thus a greater Bulk of the Fluids is driven against the Solids, to their Prejudice: and when the Juices are foul, and thus subtilized by the Heat, they are rendered sharper, more pungent and corrosive; whence they must of necessity become more mischievous to the Body. For these Reasons the *Bath* must be carefully managed, so as to be kept barely tepid, or equably warm; and if it be necessary to continue long therein, hot Water should now and then be let into it, to prevent its growing too cold.

*Cautions
against
Bathing
too hot.*

28. In the *last Place*, we shall say a Word or two of the proper *Diet* and *Regimen*, to be observed in drinking the *Waters*. For as no Remedy, without a proper Regimen, can have its Effect; so a Course of *Mineral Waters* requires an exact Care in this Particular. There are two *Errors* generally run into by the Drinkers; viz. indulging themselves either too much, or too little. Some Physicians are so

*The Re-
gimen to
be observed
in a Course
of the
Waters.*

scrupulous as to forbid their Patients the Use of all acid, saline and spicy Meats ; tho' perhaps these alone are pleasing and agreeable to them : but the Point of Exactness is here, for every one not greatly to recede from his usual Custom ; otherwise the Appetite may be hurt, Digestion not well perform'd, and Crudities and new Disorders generated. Others, who have a principal Regard to the Stomach, only advise the Use of spirituous and aromatic Things ; which is a great Hindrance to the Business of Excretion : for common Experience testifies, that such things bind up the Belly. Above all, Voracity, and turbulent Disorders of the Affections, should be prevented, as great Enemies to Digestion ; whence the Body is loaded with an useless Weight, and the *Waters* rendered ineffectual for subduing and discharging the Crudities of the Body. The Stomach also will be weakened and relaxed by this Procedure, and the *Waters* now plentifully drank, remain longer therein ; and thus give Rise to many Inconveniencies.

How destructive the turbulent Passions of the Mind are, appears from daily Experience in a State of Health ; and unless well regulated, will prove more pernicious in a sick State, and a Course of the *Waters*, whereby the Humours and Foulness of the Body are put into Motion ; so that *Apoplexies*, *Palsies*, and the like *nervous Distempers*, have proceeded from a Misconduct in this Particular. To conclude with a wholesome Admonition, infirm Persons should not rashly venture upon a Course of *Drinking* or *Bathing* ; especially without the Observance of a proper Regimen*.

S E C T.

* The Rules and Cautions here delivered are so just, and plain, as to require no farther Comment or Illustration.

S E C T. IV.

Of the Correspondence between the Medicinal Waters of HOT and COLD SPRINGS.

1. **I**T may prove of some Consequence to the Art of *Medicine*, to shew the Affinity there is between the *Waters of Hot and Cold Springs*. That there should be such a Relation between them may at first seem strange; especially as the common Opinion inclines to the contrary; and as the Ancients have not a Word upon the Subject. But upon an exact Enquiry it will appear, that these *Springs* have not only an Affinity; but even an Equality, in their *Origin, Principles, and Medicinal Virtues*.

2. Philosophers are divided about the *Origin* *The Origin of Springs and Rivers.* of *Springs*; some deriving them from the Sea, and the central Parts of the Earth. But this Opinion being contrary to the Laws of Mechanics, Hydrostatics, and Reason, it is deservedly rejected. On the other hand, 'tis evident to the Senses, that all *Rivers* and *Springs* may proceed from the *Regions of the Air*. For Rain, Snow, Clouds, Mists, Dews, and Hoar-frosts, actually afford a large Supply to *Springs* and *Rivers*: whence in the greater Plenty Rain falls, the higher they both rise; and approach near to a State of Dryness, in great Droughts. Add to this, that many *Springs* rise in *Vallies* and low Places, on account of the Waters transuding thro' the Banks of the higher Rivers; or are form'd by others, seated on the Tops of Hills and Mountains; where the Rains fall and strain thro' the

numerous Windings of the Earth, till at length they collect, and rest, either upon a solid or clay Bottom, as that of *Stone* or *Marle*; which keeps them from descending lower: so that upon encreasing, they can only now rise upwards; and thus discharge themselves in the Nature of a *running Spring*. This, upon an Examination of the whole Matter, appears to us the true and genuine *Origin of Springs*.

And in this manner *Springs* continually overflow, and discharge their Water; whilst that which comes later to the Receptacle, drives away the former: and thus they form Brooks, which are often increased by the falling of *Rains* and the Torrents of melted *Snow*, so as, in time, to cut themselves Channels in the Earth; and meeting with other Brooks in their Passage, at various Distances from the first Spring-head, they unite therewith; increase their Stream, and now wearing a wider and a deeper Channel, make *Rivulets* and *Rivers*, even those of the largest kind; which spreading wide, at length pour into the *Sea*, all that Mass of Water which had first fallen out of the *Air*. And for the Origin of those *Springs* which are sometimes found on the very Tops of Mountains; it may very justly be ascribed to the Condensation, Resolution or Distillation of the Clouds in those exceedingly high and cold Places.

*The
Strata of
Moun-
tains and
the cortical
Earth.*

3. As, therefore, *Springs* originally arise in high Hills and Mountains, we must next examine what Matters are contain'd in the Caverns of such Mountains, capable of mixing themselves with the *Waters*; and communicating a *Medicinal Virtue* thereto. And here we must reject the nobler Metals, *Gold* and *Silver*; the *Mines* whereof are extremely rare, over the Globe: nor can the firm and compact
Texture

Texture of such *Metals* be dissolved by the *Water*, or impregnate it with any *Medicinal Quality*. It is manifest to the Eye, that *Mountains* consist of several Beds or *Strata*, the principal whereof are *sandy, stony, calcarious, clayish* or *marly*; and of all the Number, the *calcarious Matter* is that which *Water* imbibes the freest. The lower Parts of the Earth plentifully abound with Beds of Iron-ore, Oker and *Pyrites* or *sulphureous Marcasites*. For as *Iron* is of such necessary Use, that Men could scarce subsist without it, Nature has spread a very large supply of *Iron Beds* over almost every Tract and Country. Thus *Stones, Clays, yellow Earths*, and most mineral Bodies, are capable of affording Iron. Mountains likewise plentifully abound with *Sulphur*; the Ore whereof is found in many Parts of *Germany* and *Italy*; and if properly treated, yields the common *Brimstone*; which is very seldom found pure and native in the Earth. The Production of *Vitriol* is also owing to the *Sulphureous Marcasites*; from which 'tis every where prepared by Art. Lastly, that *Mineral Gas*, or *Sulphureous Vapour*, which pervades every Part of the Earth's Crust, and the Bowels of the Mountains, appears to be the thing that works the Changes upon all Mines and Minerals. This *Gas* is frequently perceived by the *Miners*; and threatens them with Suffocation. Its Origin is owing to the *Sulphureous Marcasites*, or *Pyrites*; which by their intestine Motion, and the mutual Action and Re-action of the Principles whereof they consist, breathe out the *Gas*, or sulphureous, pungent, volatile Vapour, we speak of.

The sensi-
ble Prin-
ciples of
Springs,
viz. Iron.

4. Having thus taken a Survey of the Materials lodged in the Bowels of the *Earth*, capable of impregnating the *Waters* that run upon them; we come next to examine what Matters, or Principles, can be exhibited by a chemical or philosophical Treatment of the *Hot and Cold Medicinal Springs*. And first, we find that nearly all of them, whether *hot* or *cold*, participate of an *irony Earth*; as appears not only by their rough, astringent Taste; but also from the okery Sediment they deposite, or throw off upon the Pipes, thro' which they pass; and the Confines of the Spring-head. For we have seen no *Medicinal Spring*, whether *hot* or *cold*, that has not afforded this kind of Oker; or solid Matter of a yellow Colour: which when well washed and calcin'd, becomes a Powder, the Particles whereof are readily attracted by the Loadstone. Even the *cold Springs* which have no pungent Taste, but seem to contain little more than a pure *Water*, are yet generally found to hold a few Particles of *Iron*, that occasions them to turn purple with Galls, and gives them their strengthening Virtue.

Fixed
Salt.

5. What farther shews the Correspondence betwixt the *hot* and *cold Mineral Waters* is, that they both afford a true *alkaline Salt*; which makes a Conflict with *Acids*, and has all the same Effects as other *Alkalies*. This I have not only experienced in the *Waters* of *Germany*, such as the *Caroline*, *Aix la Chapelle*, &c. but *M. Pascal* also confirms the same of the *Bourbon Waters* in *France*; and declares in his *Treatise of Mineral Waters*, that, by joining this Salt with an *Acid*, it became a *neutral Salt*; that it precipitated a *Tincture of Coral* made with an *Acid*; and dissolved coagulated Milk,

Milk. The same thing is likewise confirmed by others, and particularly by Dr. *Gracchius*, chief Physician to the King of *Sweden* : for tho' there are few *Mineral Springs* in that Country, yet this Author has solidly demonstrated the Existence of an *alkaline Salt* in a particular cold and brisk Spring of that *Kingdom*.

6. It appears therefore that both the *hot* and *cold Mineral Waters* agree in containing an *irony Substance* and an *alkaline Salt*. The next Point to be considered is, whether they both contain the *subtile, volatile Mineral Principle*. And we assert, that all *Medicinal Springs*, whether *hot* or *cold*, do contain it; and in Proportion to the Quantity thereof, have a greater or less Effect upon the Body. The same Experiments and Observations that manifest its Existence in the *cold Waters*, do it likewise in the *hot* : upon which we have largely insisted in our *first Section*. There is however this Difference between the *hot* and *cold Waters*, that the *volatile Principle* remains longer in the latter, than in the former: on account of the Heat that dissipates it sooner.

7. To account for the *Origin and Production* of this fine *volatile Spirit*, and the Cause of *Heat in Mineral Waters*, is no easy Matter. The Hypotheses hitherto advanced for this Purpose, seem all of them insufficient; excepting that of the curious Naturalist Dr. *Lister*, with whom we here agree; as he proceeds upon the Footing of Experiment and Observation. This Author deduces the Cause of the subterranean *Heat*, as likewise of Earthquakes, *Vulcano's* or fiery Mountains, from the *sulphureous Marcasites* heated and kindled in the Bowels of the Earth. This Position receives great Light and

Ætherial
Matter.

Origin of
Heat in
hot
Springs.

Con-

Confirmation from the known chemical Experiment, of mixing together equal Quantities of *Brimstone* and *Iron-filings*, and making them into a kind of *Paste* with *Water*; wherewith the Ingredients being sufficiently moistened, produce both *Heat*, and, if the Quantity be large, actual *Fire*. For when the Mass is thus prepared, and suffered to lie for twenty-four Hours, it ferments, heats, swells, and changes Colour; and being now taken out, broken to Pieces, laid again on a Heap, and exposed to the open Air, it soon smoaks and breaks out into Flame. As *Marcasites*, therefore, do certainly abound plentifully in the *Earth*; and consist of *Iron* and *Sulphur*, wrought into a Mass; 'tis hence obvious to conceive, that a large Bed of them, lying under Ground, and being moisten'd by the *Water* that runs over them, will produce a Dissolution of the Principles whereof they consist; whence, by their mutual Action and Re-action upon one another, there may arise a very intense Heat, and Swelling, capable of bursting out into open Flame, upon the Access of the external Air; where any Cracks, Fissures or Caverns of the *Earth* admit it. For 'tis Air alone that can animate secret and concealed Fire into manifest Flame. And thus the Fire prevailing in the dark Recesses of the Earth, may easily heat, in a greater or less degree, the *Waters* that run by it; according as they approach to, or recede from the Places where it spreads: Whence Waters may come with different Degrees of Heat or Coldness to the Spring-head.

Origin of
the Spirit
in Wa-
ters.

8. To these *sulphureous Marcasites*, and their mutual Action upon one another, may be attributed (1.) the *mineral, sulphureous Spirit*, (2.) the *alkaline Salt*, and (3.) the *subtile, vitriolic Principle*

Principle of Medicinal Waters. For the Vapour which arises from *burning sulphureous Marcasites*, is of an extremely penetrating, simple, and highly elastic Nature ; so as readily to enter and mix itself both with the *hot* and *cold Waters* in their Passage : it being the Property of all *Waters* easily to receive, lodge and detain, dry and subtile Exhalations ; as evidently appears from the Instances of *Vitriol*, *Nitre* and *Salt*, which are nothing more than dry, acid Fumes, collected and concentrated in an aqueous *Fluid*.

9. That there should be both *cold* and *hot Medicinal Springs*, may happen in this manner. When the *Waters* take their Course near to these Beds of *burning Marcasites*, they thence are heated ; but if the *Marcasites* lie deep, and their Bed be not large enough to afford an actual Fire, but only a heated Vapour ; this Vapour breathing upwards, thro' the Cracks and Fissures of the Rocks, and Pores of the Earth, may insinuate itself into the *cold Water*, running high above the Bed ; and thus produce a *cold Medicinal Spring*. And hence it is, that, generally, there are *cold Springs* found adjacent to *hot ones* ; and a large Discharge of sulphureous Vapours about both *hot* and *cold Springs*.

10. It may here be demanded, Why, if this *Mineral Spirit* be owing to the Fume of *Sulphur*, it has not the same fetid Smell as common Brimstone ? This Question is easily answered. For a Difference must be made between the *common Sulphur*, artificially extracted from its Mine, or Ore ; and the pure *native Sulphur*, found in the Earth's Bowels. The *common Sulphur* of the Shops, is extracted by means of culinary Fire, either of Wood or Pit-coal ; whence the pure native Matter of
the

the *Sulphur* is mix'd in with an *empyrumatical Oil*, with which all burnt Wood and Coals abound: whereas the *native Sulphur*, that has not felt the Fire, is not tainted with this *empyrumatical Mixture*; but remains of a simple Nature, without any disagreeable Odour: as may be illustrated by the following Experiment. If an Ounce of *Iron-filings* be put into a Glass-vial, and a Quantity of pure and strong *Oil of Vitriol* be dropt upon it, and mixed therewith, then three Parts of *Water* added to the Mixture; there immediately arises a great and frothing Ebullition: and at the same time a most pungent sulphureous Vapour endeavours to break out; so as scarce to be contain'd in the Vial, by the Strength of the Thumb. But if this Vapour be a little held in by the Thumb, pressing upon the Orifice of the Vial, and a flaming Candle be applied to the Neck upon removal of the Thumb, there immediately bursts forth an Exhalation, with a Crack and Flame, resembling like Lightning. And yet this Vapour, tho' totally sulphureous, has nothing at all of the fetid Smell of Brimstone. And perhaps if a way could be found to obtain a large Quantity of this Vapour or *Spirit*, it might prove answerable, in Virtue and Effect, to the volatile, aerial *Spirit of Mineral Waters* *.

Genera-
tion of the
fixed Salt
in Wa-
ters.

II. We now proceed more particularly to examine into the *Origin and Generation of the fixed Salt* contained in these *Waters*. It is to this Day a prevailing Opinion among Philosophers, Physicians and Chemists, that there is naturally no such thing as an actual and *native, alkaline Salt*, whether fixed or volatile; and that such a *Salt* is only producible by Art, and

* This affords a Hint to the curious Chemist for imitating some of the natural *Mineral Waters* by Art.

and the Help of Fire. But this Opinion is contradicted by daily Observation and Experience; for the *Waters* both of *hot* and *cold Medicinal Springs*, do without any Addition, and only by a proper Treatment, afford a copious *fixed Alkali*. Besides, those who are conversant in the *History of Countries*, must know, that in certain Parts of the East, and especially in *Egypt*, there is dug up from the Earth a large Quantity of *alkaline Salt*, which the Ancients called by the Name of *Nitre*; and is such as the Artificers use for the making of *Soap* and *Glass* *.

12. The Questions to be here considered are, Whether the *alkaline Salt* contain'd in *Mineral Waters*, proceeds from the Entrails of the Earth; and, whether it may properly be called the *Nitre of the Antients*? There are many Reasons against the Affirmative of these Questions: particularly because we no where in *Europe* † find any dry, *alkaline Salt* under Ground: nor do any other *Springs* contain it, besides such as are medicinal, and impregnated with a *Mineral Spirit*. Whence we are obliged to seek for its Origin elsewhere. Upon a careful Examination of the Matter, we conceive this *Alkaline Salt* proceeds from the *Mineral Spirit* these *Waters* contain; which, by means of its *latent Acid*, joining itself with the *calcareous Earth* they abound in, thus degenerates into a *Salt*, exactly resembling *alkaline Salt*. For 'tis manifest, by a variety of *chemical Experiments*, that *Salts of an alkaline Nature* may be made from *Quick-lime*, *Cbalk*, *Plaster of Paris*, *calcareous*, and all kinds of *alkaline*

* See *Voyage de Levante*. Livr. II. pag. 780. & Carol. Clus. de Exotic. Lib. II.

† See *Bellon. Observat.* Cap. 21.

alkaline Earths, by mixing them with *acid Spirits*; or even with an *aluminous, vitriolic, or common Salt*: and these artificial *alkaline Salts* exhibit the same Phænomena, and produce the same Effects, in all kind of Trials, as the *alkaline Salts* procured from *Mineral Waters*. And it is certain, that a *calcarious Matter* lodges in all *Mineral Waters*, whether *hot or cold*; and sometimes in such Plenty, as to deposite a stony Crust about their *Springs* *. For it must not be imagined, that the *calcarious Matter* contained in *Waters*, is owing only to such Stones as are usually burnt into *Lime*, by the Fire. There are whole Tracts of Mountains in *England, Switzerland, Italy* and other Countries, of a white, chalky or *calcarious Earth*, which impregnate the *Waters* that pass thro' them, and render them unwholesome; so as to produce stumous Swellings, and other Disorders. The greatest Part also of our own *Springs* abound with such a *calcarious Earth*; as is manifest by dropping *Oil of Tartar* into the *Water*: whence it turns milky, and lets fall a white Sediment to the Bottom.

13. The *alkaline Salt* contain'd in these *Mineral Waters*, is either volatile or fixed. By *volatile Salts* we do not here understand such as are urinous, and extracted from animal Substances, by the Fire; but such as are of a changeable Nature, and easily dissipated by Heat. A *Salt* of this kind is found in most *brisk, and cold Springs*, which make a Conflict with *Acids*; but lose all their saline Taste upon being heated or boiled; and leave little or no
alkaline

* The Existence of this *calcarious Matter* in *Waters*, is rendered evident by Dr. Lister, in his Examination of the *Mineral Waters* of *England*. See his first *Exercitatio* on the Subject.

alkaline Salt, but much *calcareous Earth*, upon a total Evaporation. There are however several *cold Medicinal Waters* that yield a *fixed alkaline Salt* upon Evaporation; and most of the *hot Springs* afford it in plenty. If we examine into the Reasons of this Difference, it appears to proceed hence, that when the *sulphureous Marcasites* are violently heated, they exhale a large Quantity not only of volatile, subtile *Spirit*, but also one that is more fixed: which joining itself to the *calcareous Earth*, strongly connects therewith into a *fixed Salt*. But when the *Marcasites* are heated in a less Degree, they afford only a subtile Vapour; which entering the *Waters*, associates itself more closely with their *calcareous Earth*; and thence produces a finer or more delicate *Salt*, that by Heat is easily separated and thrown off into the Air.

14. And nearly in the same manner is produced that *subtile Vitriol* wherewith certain *Mineral Waters* are impregnated. For every one knows, that *green Vitriol* is produced by the Mixture of an *acid, sulphureous Spirit*, with an *irony Substance*. But 'tis manifest, that most *Mineral Waters* contain a Quantity of *irony Matter*: when, therefore, the subtile, acid, sulphureous Exhalations, in rising upwards, meet with the irony Particles dispersed in the *Waters*, they unite themselves thereto; and thus produce a *vitriolic Principle*, of a Texture less strong, proportionably, as the Union is less intimate. And the Connexion cannot possibly be strong, because the *sulphureous Vapours* are so extremely fine and subtile, as to take less hold; besides, they cleave only to the finer irony Particles, which are separated from one another by the Interposi-

Origin of
the vitriol
lic Prin-
ciple in
Waters.

tion of the *mere Water* : whence a close Contact is prevented, and the *vitriolic Principle* rendered easily alterable, and easily separable, from the *irony Particles*. And hence appears the Reason why, upon heating such *cold Mineral Waters*, they immediately lose all their pungent Taste, and Faculty of turning inky with *Galls*. But for a fixed *vitriolic Salt*, capable of enduring the Fire ; no such thing is to be found in *Mineral Waters*.

An Alkaline and vitriolic Principle at once in Waters.

15. It will seem strange to many, that the *hot Springs* which contain an *alkaline Salt*, should likewise contain any thing *vitriolic* : as imagining that all *Alkalies* destroy the Texture of *Vitriol* ; so that they cannot both subsist in one Subject. But this Difficulty is easily solved, for daily Experience shews, that *alkaline* and *vitriolic Salts* may subsist together. We have an eminent Instance hereof in nearly all the *cold Medicinal Springs* ; which manifest a *vitriolic Principle*, both to the Taste, and by the Colour they receive from *Galls* : and yet make a considerable Effervescence with *Acids* ; which shews their *alkaline Nature*. Reason also confirms the Possibility of the thing ; for the *Mineral Spirit* lodged in the *Waters*, may at once join one part of itself with the *alkaline Earth*, and so produce an *alkaline Salt* ; and unite its other Part with the *irony Earth*, and thus produce a *subtile, volatile Vitriol*. But the Case is quite different when a *Solution of Vitriol* is added to a Liquor already impregnated with an *alkaline Salt*, or when an *alkaline Liquor* is dropt into a *vitriolic Water* ; because they both by this means make an immediate Conflict, and begin to destroy each other. Whence, according to the Difference, Time, and Order observed in the Mixture, there must necessarily ensue

ensue a different Effect. And thus we hope to have sufficiently proved the Agreement and Correspondence betwixt the *Principles of hot and cold Mineral Waters*.

16. We come now to the other part of our Design, to shew the remarkable Similitude, and Correspondence, which these *hot and cold Waters* have in their Virtues and Operations. And this would be an easy Task, if Arguments *à priori* were a sufficient Proof: For where the Principles of Action and the Ingredients are alike, they must needs produce the same Effects: But both the *hot and cold Medicinal Springs* contain a highly penetrating, *Mineral Spirit*, a *volatile* and a *fixed Alkali*, &c. and therefore their Virtues and Effects should be correspondent.

Correspondence in the Virtues of hot and cold Waters.

17. But to leave this kind of arguing as less certain, we proceed to Experience and constant Observation. And first, as the fundamental Indications, whereon the whole *Theory and Practice of Medicine* depends, regard either the opening of Obstructions, correcting the peccant Matters, strengthening the Fibres, and, as occasion requires, discharging what is useless out of the Body; so both the *hot and cold Medicinal Waters* admirably answer these Intentions. For by means of their elastic, penetrating *Spirit*, and *alkaline Salt*, they dissolve and wash away the stagnant Humours in the Canals, take off the Sharpness of the Juices, and break the Coagulations and Viscidity of the Blood. They likewise, by the Quantity of *mere Water* they contain, dilute, prepare and correct the crude and ill concocted Juices, dissolve their *Salts*, and blunt their Force. By means of their subtile *vitriolic Principle*, and *ætherial Spirit*, they restore the

due Tone and Spring to the weakened Solids; and thus nobly promote the Business of Circulation. Lastly, they forward all kinds of Excretions, open the Out-lets, discharge the offending Humours, and throw what is superfluous out of the Habit, either by Vomit, Stool, Urine, Sweat or Perspiration: and all this in so easy and gentle a manner, as can be expected from no other Remedy.

18. To touch upon a few Particulars; the drinking of these *Waters* is appropriated to Diseases of the Stomach. Thus it excellently cures Distempers of that Part, quenches Thirst, restores a lost Appetite, removes Weight at the Stomach; washes away the viscid Juices thereof, checks an immoderate Appetite, and cures Morning Retchings and Vomitings. Both the *hot* and *cold Wells* remove Obstructions in the Mesentery, Liver, Spleen and bilious Ducts; rectify an ill Habit of Body, cure the Scurvy, Jaundice, Melancholy, stubborn quartern Agues, and other intermittents; especially such as were stopt too soon; or whilst the Cause still remain'd behind.

19. They are both excellent in curing Diseases of the *Lungs*; as the moist Asthma, &c. nor are they in the least prejudicial to consumptive Persons; especially where the Disease arises from an Obstruction of the *Viscera*; and for this Purpose, in particular, Dr. *Morton* earnestly recommends the *Islington Wells*, the Virtue and Efficacy whereof he experienced both in himself and others*. We omit, for Brevity's sake, the great Correspondence between *hot* and *cold Waters* in stopping large Bleedings, too great Fluxes of the Hæmorrhoids or Menfes, and restoring such Fluxes when obstructed; and in curing

* See *Morton. Phthisiolog. Lib. II. Cap. 2.*

curing various Diseases of the *Bladder* and urinous Passages, the *Gout*, *Rheumatism*, *Catbars*, *Defluxions*, and other internal Disorders.

20. There is likewise found a great Affinity in the *external Use* of *cold* and *hot Mineral Springs*; for both of them, in the way of Bath, dissolve hard Tumours, open the Pores of the Skin, confirm and strengthen the nervous and musculous Parts, weaken'd by a Defluxion of Humours, &c. On the contrary, they relax such Parts as are grown stiff and rigid by spasmodic Contractions; and thence become serviceable in the Palsy, Contractions and Fixedness of the Limbs; as also where the Parts are swelled or full of Pain. They both likewise prove eminently serviceable in all Foulness and Deformities of the Skin, drying up Scabs, Botches, and Breakings out upon the Body, and curing even the Leprosy itself.

21. And as both the *cold* and *hot Waters* have these extraordinary Virtues; they agree no less in the Mischiefs they produce, when imprudently used. Thus the drinking of neither is safe, where the *Viscera* are hard, and scirrhus; where the Humours are extravasated, or lodged in the Cavities of the Head, Throat or Abdomen; where the Stomach, Lungs, Mesentery, and Intestines are ulcerated, or impostumated. Their Use is also prejudicial in such Persons as are subject to the Apoplexy, Falling-Sickness, inveterate Pain on one side of the Head; or where the Memory, and the external and internal Senses are impaired. Again, 'tis improper for Persons to use the *Waters* who are afflicted with the convulsive *Asthma*, a *Polypus* in the Heart, the Dropsy in the Breast, or are worn out with a Consumption, afflicted with cancerous, eating

Ulcers, proceeding from a venereal Cause, or labour under an involuntary Efflux of the *Semen*. Lastly, they must be cautiously used in all kinds of Inflammations, both of the external and internal Parts; unless where the Disease seems abated, or going off.

Wherein
the hot
and cold
Springs
differ from
each other.

22. And tho' there hence appears a great Conformity betwixt the *cold* and *hot Medicinal Springs*, yet there are several Differences to be allow'd therein; tho' such as do not destroy the general Correspondence and Harmony between them. Thus they evidently differ in respect of *Cold* and *Heat*; and accordingly are to be well distinguished, with regard to the Disease and Constitution of the Patient. They differ again in this, that the *cold Waters* contain more of a *volatile*, and the *hot ones* more of a *fixed Salt*. So likewise the *cold Waters* hold a more copious *subtile Vitriol*, than the *hot*; and some few of the *hot ones* likewise contain a true *Brimstone*, in Substance; as those of *Aix la Chapelle*. Lastly, there is this considerable Difference between them, that the *cold Waters* are always more abundant in the *subtile, Mineral Spirit*; which is easily dissipated in the *hot ones*.

And from
themselves.

23. There is also this remarkable Difference between the *cold Mineral Waters* themselves; that some of them are impregnated with more *Mineral Spirit* than others; as the *Pymont Waters* in particular. And some of them, besides an *alkaline Salt*, contain also one that is *neutral*; and some of them no more than a *neutral Salt*, as the *Epsom Waters* and others. Some of them likewise contain much *irony Matter*, as those of *Pymont*; and others again abundantly less. In general, both the *hot* and *cold Springs* differ from those of either kind

kind in respect of the *mere Water*, which contains the other Ingredients : Thus several of them hold a crude and ponderous *Water*, others a hard and light one ; and others again, such as is soft and light. And hence it is that some of them are better suited than others to the Cure of particular Distempers.

24. These Differences in *Mineral Waters* Doctrine of the preceding Discoveries. may direct us to form several Axioms, of considerable Use in the Art of *Medicine* : For Instance the following. (1.) Persons of slender Vessels, tender Fibres, weak Nerves, and subject to spasmodic Contractions, should rather use the *hot Springs* than the *cold*. (2.) Persons of robust Habits, and strong Fibres, but labouring under Obstructions and stubborn Disorders, can better bear the Use of such *hot* and *cold Waters* as operate violently, and have a greater specific Gravity. (3.) Such *hot Springs* as afford a hard and ponderous *Water*, repel strongly, so as easily to cause Thirst, Fevers, the Head-ach, and strike external Disorders inwards : whence they are to be used with the greatest Caution. (4.) Those *Springs* that contain a soft, light and mild *Water*, are best fitted to supple and relax stiff Limbs, and such Parts of the Body as are grown rigid ; open the excretory Ducts that lead outwards, and promote a Discharge thereat.

25. Lastly, this Difference is to be observed Cold Springs preferable to the hot. of the Nature and Use of the *cold Mineral Springs* ; that they have a more noble and excellent Property than the *hot ones*, by reason of the greater Quantity of *Mineral Spirit* they contain. Their *Water* is also lighter than that of the *hot Springs* ; which on account of their *Heat*, easily dissolve many impure and gross Matters in their Passage thro' the Earth. And

yet it is certain from Experience, that the *cold Waters* prove more mischievous, than the *hot*. The reason whereof seems wholly owing to their *Coldness*; which is very pernicious to some Constitutions, when it comes to the inner Parts. That the drinking of *cold, common Water* proves dangerous both to Men and other Animals, is a known Observation: but especially to drink it violently cold, when the Body is heated with Exercise; or when the Person has a strait and narrow Chest, a relaxed Stomach, weak Intestines, and feeble Nerves; which is generally the Case of old Men, and Children; this Procedure is highly dangerous. The Risk of thus drinking very *cold Waters* is the greater if the Stomach be empty: for by this means the *cold Water* comes into an immediate Contact with the more sensible nervous Coats of the Stomach, and may prove very hurtful thereto. Whence it is my constant Advice, that the *cold Mineral Waters*, drank in the Morning, should be a little warmed; but so as not to lose the fine *Mineral Spirit*. And by this means such *Waters* are not only rendered safe, but much more effectual in the Cure of Diseases.

S E C T.

S E C T. V.

WATER *considered as an* UNIVERSAL
REMEDY.

1. **H**OW much an *universal Remedy* has Difficulty of discover- been the Desire of all Nations and ing an Ages ; is well known to those who are conver- universal sant in the *History of Medicine* : and if any Phy- Remedy. sician could be so happy as to find it, what Reward were equal to the Discovery ? But as we are hitherto possess'd of no one Medicine, that will certainly, and at all times, cure any one Distemper ; there are but little hopes of discovering a single Remedy for all the various Diseases with which Mankind is afflicted : especially as they happen in Bodies of different Constitutions ; and proceed from different, and often contrary Causes.

2. But if there be, in Nature, any Remedy Water deserving the Name of *Universal*, 'tis, in our approaches Opinion, no other than *common Water* : the nearest to Use whereof is so necessary, that Life and an uni- Health cannot subsist without it. And by versal its Assistance all kinds of Distempers are cur- Remedy. ed ; the Body preserved sound ; and defended from Corruption ; that utter Enemy to Life.

3. To lay the better Foundation for shewing by solid *Arguments*, that pure, *simple Wa-* Whence *ter*, is a kind of *Universal Remedy*, we shall incurable first observe, from the necessary Destructibility Diseases of the Body, what Diseases are in themselves proceed. *incurable*. As to the natural Necessity of Death, 'tis evident, that the Duration of the human
Body,

Body, and its Preservation from Corruption, entirely depends upon the continued and uninterrupted *Circulation of the Blood and Juices*: for so long as this Motion remains entire, so long the Body is said to be alive: but as this Motion gradually ceases, Death gradually comes on. This Motion therefore is the only thing that preserves the Body from Corruption; by preventing Rest, the Cause and Foundation of all Putrefaction, in that heterogeneous Fluid whereof all the Parts of an animal Body are form'd.

4. The *human Body* would certainly last for ever, if the Circulation of the Blood could be therein for ever continued: but the Condition of human Nature allows not of this; because the Circulation of the Fluids, whereon Life depends, is performed by means of Instruments, which consist of the elastic Fibres of Muscles, that have a reciprocal Dilatation, and Contraction: and are Vessels of greater and less Capacity; whence if the Spring, or Force of the Fibres, be so weakened as no longer to give the requisite proportionable Motion to the Juices, that they do not freely and readily circulate in the finest Canals, there must, of necessity, ensue Stagnations and Corruptions of these Juices, in the fine capillary Vessels, and thus produce Diseases and Death.

5. And as in all Machines, the Springs, and moving Powers, by reason of a Change in the Matter whereof they consist, at length become weak and useless, in the same manner does the Body itself; the Fibres thereof, whereon the Motion wholly depends, growing hard, solid and dry with Years. And thus they not only become more indisposed to Motion, but also the fine Canals of the Body are rendered

rendered straiter; insomuch that the Fluids have not their free and equable Motion thro' them. We find a Proof of this in the Flesh of old Animals; which, by reason of its Hardness and Solidity, requires a greater Heat and longer Boiling, before it will grow soft and tender. And hence 'tis manifest, that if the *Fibres* and *Vessels* of the Body were to continue in the same State, and degree of Mobility, and the Pores in the same Openness; Life might thus be prolonged for ever, unless some violent external Cause should prevent it. That this is, in the *Nature* of the Thing, any way possible to effect by Medicines, Regimen, and Diet, will seem inconceivable to those who are unacquainted with the Powers and Laws of natural Bodies. 'Tis however certain, that most Men do not arrive at that Period of Life, which the Body, by its natural Frame and Make, was intended for: and this thro' a want of knowing or observing the *Rules of conducting the Body, thro' all its Stages*. And hence it is, that the greatest part of Mankind, thro' Intemperance in Diet, Ignorance in the Art of governing the Passions, and a Neglect of those things which are prejudicial or serviceable to the Body; certainly shorten their Lives, and procure Diseases to themselves*.

6. This Doctrine, of the internal and natural Cause of the Destruction of the Body, will lead us into the true Nature of *incurable Diseases*. For as by the Laws of Motion, and the Laws of Reason, there must ever be a Correspondence betwixt the Agent and the Patient, for the Production of an Effect; if there shall at any time happen inveterate and stubborn Ob-

* Whoever desires to see this whole Affair deduced, may consult the Lord Bacon's *History of Life and Death*.

Obstructions in the Vessels of the Body ; large Discharges of Humours in the Cavities thereof, and thence actual Putrefactions ; what Remedies can the Art of Medicine here supply ? What can Physick do in deep-seated Inflammations, that cause actual Mortifications in the noble and necessary Parts ? Lastly, what Cure can we rationally hope for in violent Convulsions, and the extreme Disorders of the nervous System ? If a Physician could be serviceable in these Cases, he might seem born for the Happiness of Mankind.

No Infal-
lible Re-
medy for
any one
Disease.

7. Let us next enquire, whether there be in Nature any *infallible Remedy* for the Cure of any Distemper. Every one knows that *Specifics* are highly recommended for the Cure of particular Diseases : thus the *Bark* is accounted a safe and certain Remedy for intermitting Fevers ; *Mercury* is highly praised for its Efficacy in venereal Cases ; *Opium* is said, with certainty, to ease all kinds of Pain ; *Steel* is esteemed the only Cure for hypochondriacal Persons ; *Castor* is prescribed as effectual in nervous Disorders ; and *Nitre* for extinguishing the burning Heat of Fevers. But to say the Truth, tho' these Remedies have their Use ; yet he who is versed in Practice, will assuredly find, that such Medicines are by no means equal to the Diseases, in which they are recommended. Nearly all Distempers may proceed from different and often quite contrary Causes ; they often skulk under different Symptoms ; and Bodies are of different Dispositions and Constitutions ; so that the same Remedies shall often act differently upon them, and sometimes produce opposite Effects. And certainly it requires, with the utmost Care, to be observed, that Remedies do not act upon the Body according

to their own Nature ; but according to the Manner wherein the Body receives them : or, in other Words, that their Virtues depend upon a mechanical, and reciprocal Action and Re-action, betwixt the Body and the Medicine. Whence appears the Absurdity of their Practice, who apply but one and the same Remedy, in the same manner, for the Cure of a Disease in different Constitutions ; without regard to the Cause and Circumstances of the Case : which is an infallible Mark of a Physician not to be trusted.

8. Having thus prepared the way, we come now to explain in what Sense we take *Water* for an universal Medicine. We assert, that *Water* is a Remedy, suited to all Persons, at all times ; that there is no better Prefervative from Distempers ; that it is assuredly serviceable, both in acute and chronic Diseases ; and lastly, that its Use answers to all Indications, both of Preservation and of Cure.”

How Water is an universal Remedy.

9. But as there is a great Difference in *Waters*, a principal Regard must be had to discover such as are best fitted for this medicinal use : since it is certain, that the Nature and Properties of particular *Waters* differ so far, as to be easily distinguished, even by the Taste of such as accustom themselves to drink *Water*. But the best way of distinguishing them is by chemical Trials, their Weight, and mixing them with different Matters. It must not be imagined that *Water* is an homogeneous Fluid ; there are numerous Experiments that manifest it to be a Mixture of different Parts. Thus all *Waters* contain an aerial or ætherial Principle, whereon their elastic Property seems entirely to depend. For all *Waters* are more or less expansive and contractive, as they contain

The Difference of Waters in regard of Spirituousness.

tain more or less Air or Æther. This evidently appears in the *Water-Thermometer*; where the included Liquor possesses a greater or less Space, according to the greater or less degree of Heat it sustains. For 'tis the Nature of all Liquors to admit a greater Quantity of ætherial Fluid when they are heated; and again reject it when they are cooled: as we know by *particular Experiments*, made in a very severe *Winter*. The Quantity of Air or Æther residing in *Water* cannot, perhaps, be better determined, than by means of the *Air-Pump*; for the more subtile *Waters* included in an *exhausted Receiver*, throw up numerous Bubbles; and if somewhat heated, flow over the containing Glass: as on the contrary, those which are grosser and more ponderous, afford fewer Bubbles in *Vacuo*.

To discover
the Levity
and Purity
of Wa-
ters.

10. *Waters* also appear to consist of a lighter and a heavier Part; and the former, as being more moveable, easily rises first in Distillation; whilst the heavier and grosser Particles require a greater Degree of Heat to bring them over: Whence 'tis observable, that *Waters* lose their more subtile Parts in boiling, and leave the cruder and less useful ones behind; as is known to all those who are curious in the making of *Coffee*: for if the ground Berries are put into *Water*, that has long been boiled; the Liquor so made becomes less quick and pleasant to the Taste. It has also been observed, that some *Waters* rise much faster than others in Distillation. *Waters* also differ extremely in their Gravity, as appears by the *Water-Poise*; those which abound with Earth and Salts causing the Instrument to rise higher, than such as are pure. But Distillation is one of the best ways of discovering the Purity of *Waters*;

as not only rendering the Quantity, but also the Quality of the Contents evident to the Senses. 'Tis surprizing to see what a large Mass of earthy or stony Matter remains upon the Distillation of some *Waters*. I once distilled two Quarts of *Spring Water*, in a Glass-body, to Dryness; repeating the Operation ten times, in the same Vessel: and by this means obtain'd a hard stony Crust at the Bottom, as thick as the Back of a Knife. Most *Waters* contain a chalky Earth, some an Oker, others a stony Matter, and others again a Proportion of *common Salt*. But the true way of examining whether *Waters* are impure, or contain any foreign Matters, is by the means of *chemical Experiments*; two whereof I have singled out for my own use, and recommend, as exactly discovering the Purity or Impurity of *Waters*. The first is, by dropping *Oil of Tartar* into them; and the second, a Solution of *Silver* in *Aqua fortis* *. If the *Waters* are pure, such as *Rain Water*, *Water distilled*, and some sorts of *Spring Water*, they manifest no Alteration upon mixing with these Liquors; but if impure and gross, they turn *milky* with *Oil of Tartar*; especially if they abound in a chalky Earth: And the *Solution of Silver* turns impure *Waters* thick, grey-coloured; and, if they participate of Iron, almost red.

11. The *Effects of Waters* also manifest their Nature, Subtily and Purity: thus those that are light and soft serve best for mollifying the Bones of Animals; and the boiling of Sea-Fish. The *Whitsters* and *Bleachers* find a remarkable difference in *Waters*; the softer and fatter

* This was Mr. Boyle's Secret for discovering the smallest Proportion of Sea-Salt contained in any *Water*.

fatter sorts thereof serving better to wash and blanch, than such as are ponderous, hard, and take Soap with Difficulty. The *Bakers* find, that the more soft and subtile *Waters* make their Bread rise best. The *Gardeners* observe, that such *Waters* as are light, subtile and spirituous, are much better to water their Beds with, than such as are hard. The *Masons*, Makers of *Terras*, and Figures in *Plaster of Paris*, find *hard Water* the best for their Purpose ; and can scarce work with such as is soft ; so as to give their Matter its due Strength and Firmness. The *Chemists* find a great Difference in *Waters* ; those of Rain being best suited to wash and edulcorate their Magisteries and Metalline Powders, viz. the Calx of Gold, Silver, the *Caput mortuum* of Vitriol, &c. as readily drinking in the Salts that *hard Spring Waters* will scarce touch. We daily observe, in the domestic Operations of brewing, washing, the making of *Tea*, &c. that the more subtile and soft *River Waters* are better for these Purposes than *Spring Water*.

Rain
Water
best fitted
for medicinal Use.

12. But for medicinal Purposes we prefer *Rain Water*, as what is naturally distilled by the Sun, and thus rendered subtile and fitter for Solutions, Infusions, Extractions, and all internal Uses. Only this *Water* being mixed with various mineral, vegetable and animal Exhalations, is thence rendered easily corruptible, if exposed to the free Air, or suffered to stand long in Vessels of Wood. The *Rain* that falls in the Month of *March*, is more durable ; as not then receiving so many Effluvia. The better to fit this *Water* for medicinal Use, 'tis proper to keep it in earthen Vessels, close stopt down. And thus if it be collected, not in Cities and Towns, as it runs from the Spouts of Houses ;

Houses, but in the open Fields ; it may be kept sound and serviceable for several Years.

13. Next to *Rain Water*, in point of Goodness, comes that of *Rivers*. But as *Rivers* proceed from the *Springs* situated in high and mountainous Places ; and as *Rains* increase these *Springs*, which running over vast Tracts of Land, drink up many different Matters from the Earth ; hence *Rivers* become more turbid and impure, the larger Tracts of Land they wash in their Course. Add to this, that they take up numerous heterogeneous Parts from the Bottom they run upon ; whence there often arises a considerable Difference betwixt *Rain* and *River Water*. Lastly, *Rivers*, being perpetually exposed to the free Air, and the Action of the Sun, have their more subtile Parts exhaled and raised into the Atmosphere, so as to supply the Matter of *Clouds* and *Rain*.

River
Water,
how fitted
for medicinal
Use.

14. There is likewise a great Difference between the *Waters* of *Rivers* : for those that have a swift Course, or run violently down from the Mountains, where they rise, into the lower Plains, are very different from those where the Course is slack and gentle ; and therefore generally rise in lower Places. Thus the *rapid Rivers* usually afford a light and subtile *Water*, not greatly subject to Corruption ; tho' somewhat improper for the feeding and nourishing of Fish ; because the Rapidity of their Motion prevents the Spawn of the Fish from clinging to their Banks ; so as to be there animated by the Heat of the Sun. But tho' these *Rivers* of swift Course do not greatly abound with Fish ; yet those they produce are well tasted and excellent. Thus the *Rhine* and the *Rhone*, which rise from the highest Mountains of the *Grisons Country*, are found to be much

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lighter

lighter than the *Waters* of other *Rivers*. And 'tis remarkable, that the Ships coming out of the River *Main* into the *Rhine*, draw much more Water in the latter. And hence the Waters of the *Rhine* and the *Rhone* appear, upon hydrostatical Examination, nearly to approach the Lightness of *Rain Water*. And as both these *Rivers* are very rapid, their *Waters* are hence rendered less corruptible; and therefore allowed, for internal medicinal Use, to excel the *Waters* of all other *Rivers*. Thus we are assured from a good Writer upon the *Water* of the *Rhone*, that “ if it be kept in Wine Cellars, put up into large earthen Jars, so as there “ to deposite its Sediment, for some Weeks “ or Months before 'tis drank, it thus be- “ comes pure and excellent; and will after- “ wards keep many Years, or even an Age, “ without spoiling or corrupting*.

15. The *Rivers* that flow gently differ from the former; not only on account of the immense Quantities of Fish they breed, but also because they generally run on fat and clayish Bottoms; or such as afford proper Bedding and Nutriment to Fish: whence such *Rivers* are not so clear and crystalline as those of a rapid Course. But then such *Waters* are of a softer Nature, and serve for the Purposes of Washing, Fulling, Scouring, &c. without any considerable addition of Soap. From hence it may easily appear, that *Rivers* are not all alike, or equally fit for medicinal Use. Those to be chose for this Purpose are clear, light, do not easily corrupt, and receive no Alteration upon the Addition of *Oil of Tartar*, or any metalline Solution. It must be constantly observed,

* Jacob. Spon. in Observation. circa Aquam Rhodan- in Act. Erudit. An. 1683. pag. 519.

served, that *Rivers* of a rapid Course, are universally more wholesome than those which flow slow and gentle.

16. *Spring Waters* also are sometimes observed to differ in their Virtues. For tho' these *Waters* owe their Origin to *Rain*, yet, according to the different Nature of the Soil, and earthy Matters they meet with or imbibe, they receive a different Nature and Disposition: whence we seldom find *Springs* of a perfectly pure and light *Water*. The greatest part of them leave a copious earthy Substance upon Distillation. There are but few that do not turn thick with metalline Solutions, or alkaline Salts. Some of them contain common Salt; and others a subtile, volatile Vitriol. If they hold common Salt, *Oil of Tartar* will discover it, by turning milky therewith: if they contain a vitriolic Principle, the Infusion of Galls, or *Balaustian* Flowers, will manifest it, by turning black. There are others again, that contain somewhat of Iron, and thence have a styptic Taste; and let fall an Oker upon standing. 'Tis therefore the Business of Art, and Industry, out of so large a Number of *Springs*, wherewith Nature supplies us, to discover the wholesomest; which are known by their Lightness, Transparency, Purity, Durability, and the Trials above-mentioned. This Difference, in *Spring Waters*, must also be observed, that some are soft, and others hard; the latter whereof are the most durable and indisposed to freeze: whereas the former easier turn to Ice. They are both of them wholesome and medicinal; if properly suited to the Disease and Constitution of the Drinker or Patient.

Spring Waters,
how fitted
for medicinal Use.

*That
Water is
agreeable
to all Con-
stitutions.*

17. Having thus shewn which *Waters* are best fitted for medicinal Use, and how they are to be distinguished and examined, we now come directly to prove the Excellence and universal Virtue of pure *Water*. Our first Position is, *That pure and light Waters are agreeable to the different Natures and Constitutions of all Men.* For since the Circulation of the Fluids, thro' the Canals and finest Vessels, is what preserves and secures the Body from Corruption, and keeps the Blood and Juices in a thin moveable State; *Water* must needs be appropriated to the Continuance of Life. The Fluids of the Body, serving to Nutrition and the vital Offices, and whereof the Solids also are composed, actually consist both of Solids and Liquids. That there are solid Parts contained in the Blood, is evident upon drying it; and that these Parts are of different Natures, some saline, others unctuous; some mucilaginous, and others earthy, appears to the Senses; by the inflammable Property they have upon Evaporation, and other chemical Experiments. In short, they are a number of heterogeneous Parts united into one Whole, which is very corruptible, when put into a State that fits it for Corruption, viz. a State of Warmth, Rest and Moisture. To prevent the Fluids from thus corrupting, and consequently infecting and converting all the other Parts of the Body, it is necessary they should never stagnate, or collect together; otherwise Corruption would immediately ensue. Whence these subtile, solid Particles, both unctuous and earthy, should not only be kept in perpetual Motion, among themselves; but also circulate in a progressive Motion, thro' the finest Tubes of the Body; that the solid Parts of the Blood may
be

be divided into extremely fine Globules, by the Motion of Attrition, or Action and Reaction between the Juices and the fibrous Parts. Whence appears the Necessity of an aerial, ætherial, fluid, and elastic *Principle*, along with a large Quantity of an *aqueous Fluid*; that is, the Necessity of *pure Water*, to secure this indispensable Effect. And hence it is, that upon examining the Blood, taken from a Man in Health, we find at least two parts of a fluid, for one of a dry and solid Matter: for I have frequently observed twelve Ounces of Blood to contain eight Ounces of a liquid, and four of a solid Substance. Again, that the Blood contains a large Quantity of a subtile, aerial, and ætherial Principle, manifestly appears from its bubbling *in Vacuo*, so as to run over the Edges of a cylindrical Glass, whereof it at first possess'd only one half. From the whole we infer, that nothing is more wholesome; nothing better fitted, or more necessary, to preserve Life than *Water*; which is so agreeable to the Nature of the human Body, and without which it can neither subsist, nor Life be long preserved.

18. Our next Position is, *That no Remedy can* *That*
more effectually secure Health, and prevent Dis- *Water is*
eases, than pure Water. If we strictly enquire *the best*
into the Cause of Health, we shall find it to *Preserva-*
be an equable and free Circulation of the Juices *tive of*
thro' all the Canals of the Body; even the *Health.*
finest that lead to the *excretory Ducts*. For by
this means it is, that what proves serviceable and
fit for Nutrition, remains within, separated for
Use by the proper Strainers; and what would
either prove useless, corruptible, and inconve-
nient to the Body, is discharged. And here it
deserves the utmost Attention, that the Ex-
cretions of the Body do not so directly, simply,

and absolutely regard *Life*, as they indirectly regard *Health*, and the due Exercise of all the Functions and Offices; inſomuch that Health, and even Life itſelf, may be endangered, without any fault in the Excretions. Thus 'tis obvious that from violent Paſſions of the Mind, extreme Pain, Inflammation of the Stomach, and the ſwallowing of Poisons, the natural Functions of the Body are ſtrongly diſordered. Neither in the moſt obſtinate chronical Diſeaſes are the Excretions ſo much to be regarded, as the Obſtructions of the glandular Parts, the Indurations, Corruptions and Sphacelations of the *Viſcera*, and Extravaſations of the Humours: ſo likewiſe in acute Diſtempers, the inflammatory Diſpoſition of the Blood is chiefly to be regarded. 'Tis therefore an equable Motion of the Blood and Juices that maintains Health, promotes the Excretion of unneceſſary Matters, affords a convenient Nutriment to the ſolid Parts, and procures to the Nerves and Fibres that moſt ſubtile Fluid, by means whereof they feel and move. But whenever this free and equable Motion is obſtructed, whether by an over charge of Humours, their Viſcoſity, or, by Weakneſs in the Spring or Tension of the moving Fibres, it becomes an immediate Occaſion to Diſeaſes; eſpecially thoſe we term chronical: for from theſe Cauſes proceed Stag-nations of the Juices in the larger and ſmaller Veſſels, Obſtructions in the *excretory Duets*, and Induration in the glandular Parts. Theſe are ſoon followed by great Impurities of the Juices, cauſing Pains and ſpaſmodic Diſorders; and not long after, by Putrefactions, which are the Bane of Health, and the direct Opposite to Life. And thus are the true Cauſes of Diſeaſes formed in the Body.

19. Every one who perceives the Justness of this Description, will readily grant that a proper Fluidity of the Blood is highly necessary, to procure a free and equable Circulation; by Means whereof the Vessels are kept always open, Obstructions prevented, Excretions secured, Stagnations and Impurities of the Juices hindered, and the Causes of Diseases cut off. And whether there be in Nature a better disposed Remedy, for procuring this necessary Fluidity to the Blood, we leave to the Judgment of sober and experienced Physicians. To us it appears, that a pure and subtile *Water* exquisitely divides the solid and viscid Parts of the Blood and Juices, so as to prevent their coagulating, or coming together; at the same time that it drinks up the useless and recrementitious Matters, of various Kinds, whether earthy, saline, or unctuous; and discharges them by the proper Outlets: and consequently, for want of a due Moisture and Motion in the Body, numerous Diseases must necessarily arise.

20. And hence, we conceive, proceeds the Reason why the Drinkers of *Water*, provided it be pure and excellent, are more healthy and longer lived than such as drink Wine, or Malt-Liquors; and why it generally gives them a better Appetite, and renders them plump and fleshy. For certainly, *Water* is a most appropriated Menstruum to dissolve the Aliment, extract its Chyle, or nutrimental Part, and carry it thro' all the innermost and finest Canals of the Body. Besides this, it readily washes off and dissolves that tough viscous Slime, which lines the glandular Coats of the Stomach, and *Duodenum*; whereby the dissolving Juices of the Intestines, which are the immediate Instruments of Digestion, may more plentifully

mix with the Food, and perform their Office. There goes a common Opinion, that the drinking of *Water* is pernicious to those who eat Fruit; but this is a great Mistake: for in *Spain*, *Portugal* and *France*, *Water* is the common Liquor; and yet these Nations freely eat Fruit all the Summer, without any Inconvenience. Again, those who drink *Water* are observed to have much sounder and whiter Teeth, than others: for Putrefaction and Corruption of the Teeth is caused by the Scurvy; a Disease prevented by the drinking of pure *Water*, which actually cleanses and washes the Blood, and discharges the Foulness thereof. Add to this that the Drinkers of *Water* are much brisker and more alert to all the Actions both of Mind and Body, than such as use *Malt-liquors*; the greatest part whereof produces clammy, viscid and sluggish Juices, hardly capable of passing thro' the exquisitely fine Vessels of the Brain and Nerves; whence ensue Indolence and Weakness of the Body, and an Indisposition and Dullness of the Limbs, both to Sense and Motion. And as this plainly appears to be matter of Fact, 'tis the more surprising, that the drinking of pure *Water*, which is so conducive to the Preservation both of Life and Health, should be so perversely, and, as it were, unnaturally nauseated by the People of our Country; whilst 'tis as strongly coveted and admired in other Nations. Such *Malt-Liquors* as are thick, and highly nutrimental, lay the Foundations of many Disorders among the Inhabitants of Northern Countries; more particularly where the Use of Brandies, Spirits, and Strong-Waters prevails. It is certainly much better for all Persons of delicate Constitutions, and sedentary Lives, to accustom themselves to the drinking
of

of the finest and purest *Water*, either alone, or mixed with Wine, to render it more acceptable.

21. Having thus considered the singular Efficacy of *Water*, by way of Prevention; we come next to examine what it will perform in the Cure of Diseases. Physicians divide all Distempers into acute and chronical. Of the acute kind the principal are *Fevers*; which from the Structure of the Body, and the Laws of Motion, appear to be an Increase of the Blood's Velocity and Force; so as to distend both the solid or fibrous and fluid Parts of the Body beyond their natural Size: this Increase of Motion having a Tendency either to overcome and discharge the Cause of the Disorder, or to destroy the Machine itself. Whence there ensues either Recovery, Death, or a Depravation of some Parts of the Machine, when the Disease terminates in another. And thus Nature, which is often her own best Physician, sometimes also produces Diseases and Death. But here we must by no means confound the rational Soul with *Nature*; which is a word we use to signify the Structure, Mechanism and Contrivance of the Body, acting with certain Powers, according to certain necessary and mechanical Laws, assign'd it by its Maker. A Physician therefore, in the present imperfect State of *Medicine*, can do no more than supply a proper Matter to this augmented Motion in continued *Fevers*, during the whole time they thus regularly continue; for they have their own natural Periods, that cannot hitherto be safely stopped by Art. This increased Motion and Distention, is attended with a great Heat, that violently dissipates the fluid Part of the Blood and Juices, so necessary to Life: whence the principal Intention is to supply this fluid Part,

That Water is curative of Fevers.

Part, in proportion as it wastes. And as the Tendency of this increased Motion is to break thro' the Obstructions, that cause the Disorder; the Blood can by no means make its way, unless sufficiently thinned and diluted with a proper Fluid: but thus assisted it may allay the Heat and Inflammation, propel the stagnating Juices, and discharge the offending Matter, that causes the Mischief. And Experience shews, that if *Water* be not the only thing, there is no better Remedy yet found for this kind of *Fever*, than a free and large Use thereof. Whence *Hippocrates* and others highly recommend an aqueous *Ptisan* for this purpose. And accordingly by this alone, with the Assistance of Rest and temperate Warmth, the most violent *Fevers* have frequently been cured, without any other Medicine. All that the best Physicians do in these Cases, is either to *Bleed* at the beginning, where the Body is full, or to exhibit an *Emetic*, if the Distemper is seated in the first Passages; or to prescribe a *Sudorific*, in order to expel the offending Cause, in the most expeditious manner: but after this, thro' the whole Course of the Distemper, they give nothing more than cooling, moistening and perspirative Remedies. The Caution required in the Use of *Water* for this Distemper is not to give it too cold, especially near the *Crisis*; and when there is reason to fear an Inflammation in the first Passages; nor when the Body is stiff and rigid, and the external Parts parched and bound up; but to wait for the time when there appears a Disposition to *Sweat*: for then 'tis ever proper to give *Water* in a large Quantity *.

22. Those

* This is agreeable to the Advice of the best Physicians, and particularly insisted on by *Comenius*, in his excellent Discourse of *Fevers*.

22. Those called *chronical Diseases*, generally arise from an Obstruction of the *Viscera* and glandulous Parts, or a Surcharge and Foulness of the Juices, with a Stagnation thereof in the larger Vessels ; all which, according to the Rules both of Reason and Experience, are therefore to be removed in order to a Cure ; But to procure this Effect, there is not a more serviceable Remedy than *pure Water*. How eminently serviceable the *medicinal Waters*, both of *hot* and *cold* Springs, are, for this Purpose, is a thing manifest and demonstrative by Experience. But the major part of their Efficacy in this respect, is beyond all Dispute owing to the Quantity of pure elementary *Water* they contain : for it were insignificant to exhibit in these Distempers the mineral, volatile *Spirit*, and the *Salt* which such *Waters* contain, without that purely aqueous Part. And accordingly there are numerous Instances of pure and light *Water*, which, without containing any Mineral Ingredients, prove of extraordinary Efficacy in the Cure of *chronical Diseases*. The Effect therefore can possibly be ascribed to nothing else, but the pure *Water*. Of this kind there are numerous Springs in *Germany* ; the Waters whereof being pure and subtile, tho' plentifully abounding with Air and *Æther*, prove curative of most *chronical Distempers* ; particularly the Stone, the Gout, the Rheumatism, the Scurvey, and Weakness in the Limbs ; and by procuring the requisite Fluidity to the Humours, they remedy Suppressions of the *Hæmorrhoids* and *Menses*.

23. As there is, therefore, sufficient Reason to persuade us that the Wholesomeness of many Springs depends upon the Goodness of their *Waters*, it follows, that where other pure *Waters*

Water
curative of
Chronical
Diseases.

ters

ters are procurable, these likewise will have the same Effects. And this also is confirmed by Experience, as may appear from the Testimonies of *Riverius* *, *Celsus* †, *Ballonius* ‖, *Sylvaticus* §, *Martianus* **, *Rondeletius* ††, *Avicenna* ‖‖, and others; who shew that the drinking of *Water* has cured Obstructions of the *Menses*; the Head-ach, Ophthalmia's, Colds, Rhuems, Inflammations, the Gout, the Colick, &c. being used either cold or warm, as the Stomach can bear, or the weak State of the Nerves requires.

Efficacy of
Water in
Tea.

24. Of what singular Efficacy pure hot *Water* is, both by way of Preservative, and Cure, appears from the Nature and Use of Tea-drinking. For 'tis certainly a Mistake to attribute all the good Effects of *Tea* to the *Leaves* of the Plant. The principal Virtue of this Infusion is doubtless owing to the Quantity of the pure hot *Water* employed in the making; whilst the Herb, by its Astringency, prevents the Fibres of the Body from being too much relaxed and weakened thereby. Therefore as numerous Diseases are attended with a strong Contraction of the Fibres, all Physicians who are well versed in Practice will be cautious of indulging too free an Use of this *astringent Ingredient* *, in such Cases.

* River. Oper. Lib. 4. Cap. 24.

† Cels. Lib. 1. Cap. 15.

‖ Ballon. Lib. 1. Epidem. pag. 106.

§ Sylvatic. Cap. 1. observat. 1.

** Martian in Hippocrat.

†† Rondelet. Prax. pag. 611.

‖‖ Avicenn. Lib. 1. Sect. 2. Cap. 16. pag. 102.

* That *Tea* is an astringent or styptic Plant, appears by several Experiments, as particularly because like Oak-bark, Balaustian Flowers, and other astringent Vegetables, it turns inky with a Solution of Iron; or the Chalybeate Waters.

Cases. And to speak a serviceable Truth, we have in our own Country many Plants, whose Virtues far exceed those of the *Indian-Tea*. And Choice should be made of these Plants for medicinal Use, according to the Difference of Distempers. Thus, for Example, in Diseases of the Breast the *Paul's Betony* is proper; *Common Betony* in Disorders of the Nerves; *Baulm* and *Penyroyal* in Diseases of the Uterus; *Ground-Ivy* in Ulcers of the Kidneys; *Buck-bean* in the Scurvy, &c. being severally made into Tea, with the purest *Water*, and drank hot. Again, *common Camomile* may be advantageously used in the way of *Tea*, against the Colick; *Parsly* in the Stone; the *Ranunculus* in the moist *Asthma*, &c *. But in all *Tea* 'tis a Caution of Moment that the *Water*, designed for the Infusion, be not long boiled; but immediately poured upon the Plant as soon as it simmers strongly, in order to prevent the Loss of its more subtile Parts.

25. It remains that we shew *Water* to be an *universal Remedy*, as it agrees not only with all Constitutions, but in all the Indications of Distempers. And first the drinking of *Water* is serviceable in every Complexion. In the *sanguine* and those of a soft Habit of Body, who have but few of the finest kind of Vessels, it causes the Blood and Juices to circulate freely: which in this Constitution would otherwise flow but slowly, and so be apt to generate Obstructions in the *Viscera*. In bilious Habits, where the Humours are in brisk Motion, it allays the
That Water agrees with all Constitutions, and answers all Indications.
 excessive

* *Rosemary Tea* is by many recommended as excellent in nervous Diseases; viz. the *Epilepsy*, *Palsy* and *Apoplexy*; and for defending the Body, and preventing the catching of Cold; especially if made with the Flowers of the Plant.

excessive Heat that would otherwise evaporate the unctuous Parts of the Blood thro' the widened Tubes and Pores of the Body. It likewise proves extremely serviceable, by diluting and thinning the Viscidity of the Blood and Juices, in Persons of melancholy and phlegmatic Constitutions.

Again, *Water* proves agreeable to Persons of all Ages. Children are frequently subject to violent Disorders from the Viscidity and Acrimony of the Milk they feed on; in which Case, besides Absorbents, diluting aqueous Remedies are of great Service. In Youth, the Surcharge and Thickness of the nutritious Humours produce various Diseases; such as Colds and Eruptions of the Skin; which are excellently remedied by the Use of diluting Liquors. And the same holds true of the Diseases of grown Persons, and Persons in Years; in all which the drinking of *Water* is serviceable. For Men of full Growth are very subject to Inflammations and Fevers; and old Men to such Disorders as proceed from Stoppages and Obstructions; in which Circumstances there can nothing be given more proper than the finest *Water*, either hot or cold. We find by daily Experience, what severe Disorders are occasioned by Irregularity in the menstrual and hæmorrhoidal Flux; to reduce which to their natural Periods, and preserve them in proper Course, I am convinced from practical Observations, that nothing is more effectual than diluting aqueous Remedies.

26. 'Tis well known, that a Fulness of Blood and Juices brings on many Distempers; but to prevent this Fulness, the most appropriated thing is *hot Water*, made into an Infu-

fiore

sion with Herbs ; which thus by dissolving the glutinous Humours, prevents the Mass of Blood from increasing too fast. A free Use of *Water* is no less serviceable in purifying bad Juices ; as it readily washes off their impure, saline and droffy Parts, thro' all the excretory Passages of the Body. Besides this, the drinking of *Water* promotes all the Evacuations, preserves the Belly soluble, keeps the urinary Passages open ; washes and cleanses the same from the Adhesion of gravelly or stony Matter, and powerfully promotes that most healthy Discharge of insensible Perspiration. Lastly, *Water* is the effectual Vehicle of all other Remedies. Thus Antiscorbutics and vegetable Medicines appropriated to cleanse the Blood, prove of little Service in correcting the Depravities of the Humours, unless by the Assistance of *Water* their Virtue be carried into the Juices and remote Parts of the Body, in the Form of Decoction or Infusion. To sum up all, in whatever Cases there is a Necessity either for altering, evacuating, opening, or resolving, *Water* is at all times the best of Remedies.

27. As *Water* is thus extensively useful, it may be proper to observe, that they who cannot procure the purest and best sort thereof for medicinal Use, must serve themselves with such Rain or River-*Water* as can be had : but if these be not obtainable in tolerable Purity, the best way is to distil them ; or else, upon a slight boiling, to correct them, by the addition of *calcin'd Hart's-horn*. It is doubtless a singular Benefit of Nature, to have large Cities and Countries well watered, with wholesome Springs ; which thus bountifully supply so much better Remedies than those of the Shops. If every prudent and disinterested Physician would

would carefully examine into the *Waters* of the Place where he resides; he might thence assuredly practise more to the Satisfaction of himself and Service of his Patients, than in the common way, by the miscellaneous Use of numberless uncertain Remedies.

S E C T. VI.

Of WARM-BATHING.

1. **W**E are abundantly supplied with Remedies both by Nature and Art: but he who has been any time versed in the Practice of Physic, will find reason to drop the boasted Preparations of the Shops, tho' ever so highly extolled; and confine himself to the Use of a few *simple Medicines*, that are easily prepared: for from these alone can any solid Advantage be justly expected*. And surely it is a Mark of Wisdom and Goodness, that the most excellent of all Remedies should every where be found in the commonest Subjects, and such as are easiest to be procured. Thus we have already shewn, that *common Water* has a juster Claim to the Title of an *universal Remedy*, than any Medicine of the Laboratory or the Shop; tho' ever so rich, costly and

* There is perhaps no *Physician* of *Judgment* and *Experience*, that does not tacitly allow the Truth of this Assertion; but establish'd Forms and beaten Paths are so attractive, that he must be guided by an uncommon Spirit that can forsake them.

and laboriously prepared. And having there proved the extraordinary and universal Use of *pure Water*, taken internally ; we here proceed to examine its Efficacy, when externally employ'd, in the way of *Bath*.

2. There is scarce any kind of Remedy, which from the earliest Antiquity, and the general Practice of Nations, has been so much celebrated, and brought into common Use, as *Bathing*. The *Egyptians*, the *Greeks*, and the *Romans*, held this Practice in great Esteem ; were very magnificent in their *Baths* ; and finding them of eminent Service in the Preservation of Health, and the Prevention of Diseases, they, as is usual in the like Cases, run into an Abuse thereof, and turned them to Luxury and Pleasure. And hence the Magnificence of the *Greeks*, and *Romans*, was in nothing more conspicuous, than in the stately Structure of their *Baths* ; as we learn from *Vitruvius*, *Seneca*, *Statius*, *Martial*, and *Pliny*. On the other hand, all the most antient and best Physicians ever held *Bathing* excellent ; both in the way of Prevention and Cure even of the more obstinate and inveterate Distempers : thus seldom using any other Remedy besides *Water*, either internally or externally ; as *Hippocrates*, *Aretæus*, *Trallianus*, *Galen* and *Aetius* assure us.

*Antiquity
and Uni-
versality of
Bathing.*

*The suits
ableness of
Bathing
to the Cure
of internal
Disorders.*

3. But chiefly the *Methodists* held this kind of Remedy in high Esteem ; whence *Celsus* * says of their Head, *Asclepiades*, that he used *Bathing* boldly ; and *Cælius Aurelianus*, the only Writer of the *Methodists* now remaining, highly magnifies *Bathing* in many obstinate Distempers. But it is the Misfortune of our times, that *Bathing* seems almost excluded the Art of

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* Lib. II. cap. 17.

Medicine; so as to be seldom used; or but in particular Cases; and when the Disorder is seated in the external Parts. The reason hereof seems principally this; that most Physicians imagine external Remedies of little Efficacy in the Cure of internal Disorders. Besides, the Physicians of the present Age, generally attribute the Causes and Symptoms of Distempers more to the depraved State of the Blood and Juices, than to the altered Nature, Strength and moving Powers of the Solids; whereas, in assigning the true Causes of Diseases, the principal Regard must be had to the Solids, which regulate the Motions of the Fluids; and in this respect *Bathing* is extremely serviceable. Since therefore the Usefulness of *Bathing* is generally allowed in Diseases of the Skin, and others, that are seated externally; it shall here be our principal Care to *recommend the Practice of Bathing for the Cure of internal Disorders; whereto it is admirably fitted, by the Attestation both of Reason and Experience.*

*Several
kinds of
Bathing.*

4. There are several kinds of *Baths*, but we shall here speak only of the *moist Kind*; or such as consist of pure *common Water*. The Antients had ways of sweating by a dry Heat; as by the means of hot Sand, Stove-Rooms, or artificial *Bagnio's*; and certain natural *hot Steams of the Earth* received under a proper Arch, or Hot-house, as we learn from *Celsus* *. They also had another kind of *Bath by Insolation*, where the Body was exposed to the Sun, for some time, in order to draw forth the superfluous Moisture from the inward Parts. And to this Day 'tis a Practice, in some Nations, to cover the Body over with Horse-dung; especially

* Lib. II. cap. 17.

cially in chronical Cafes, to digest and breathe out the Humour that causes the Distemper.

5. *Moist Bathing* is of two kinds, *hot* and *cold*. *Cold Bathing* was also in high Esteem among the antient Physicians, for the Cure of Diseases, as appears from *Strabo**, *Pliny*†, *Hippocrates*‡, and *Oribasius*§; whence washing in the *Sea*, and plunging in *cold Water*, were recommended by them. And this Practice agrees with Reason; for where the Heat diffused in the Body is to be collected, or brought upon the *Viscera*, and the Strength of the weakened Parts to be recovered, *Cold* is of more Service than Heat and Moisture. But *cold Bathing* is not our present Subject**.

6. Again, the *Waters* which may be used for Bathing are of two kinds; viz. either pure and simple, or such as abound with heterogeneous Parts, of different kinds. Those we intend are the purest, lightest, and simplest, free from all Participation of mineral or metallic Parts. For 'tis their external Use alone we would here recommend, in the Cure of internal Disorders. The *Water* therefore for this Purpose should be what we call *sweet*; that is, perfectly tasteless and scentless; which also, upon boiling, leaves no tastable Substance behind; and approaches

*The best
Water
for warm
Bathing.*

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near

* Strab. in Geograph. Lib. LXV.

† Plin. Histor. Nat. Lib. XXIX. Cap. 1.

‡ Hippocrat. de Humidor. Usu.

§ Oribas. Lib. VI. Cap. 27.

** For fuller Information the Reader may consult Sir John Floyer and Dr. Baynard on COLD BATHING: But the Subject requires a farther mechanical and experimental Treatment, to bring it upon the safe Footing of *warm Bathing*; and point out the necessary Rules and Cautions for a discreet and advantageous Use, in the several Cafes whereto it is adapted.

near to the State of Distilled or Rain Water : as may be readily and exactly discovered by its specific Gravity. This Water also should be such as does not turn thick, or precipitate with any metalline or mineral Solution ; but easily heats over the Fire, and readily boils Pulse, or the Flesh of old Animals, tender ; and lastly, such as best serves the Purposes of Washing, and taking Stains out of Linen, or extracting the Tincture of *Tea*. And such a kind of *Water* is that of *Rain*, collected in the free and open Air, remote from large Towns ; or that of *Rivers*, especially after the Land-floods come down into them. There are also some few *Springs* which afford a very subtile, pure and light *Water*, extremely proper both for internal and external medicinal Use.

7. Such light and simple *Spring Waters* as these are to be highly valued, on account of the matchless Virtue they have, both in preserving and recovering Health. For 'tis the Property of these subtile *Waters*, readily to enter the Pores, and finest Canals of the Body ; dissolve all the gross Matter they meet in their Way ; drink up the morbidic Salts ; and carry all Impurities clear out of the Habit. They have also the Property, when used externally, of softening and relaxing the dry and hardened Parts ; opening the Pores ; and procuring the requisite Fluidity and Circulation to the Blood : whence all the Parts of the Body are commodiously water'd, recruited and repaired. And to say the Truth, many natural *hot Springs* owe all their curative Virtue, to the Subtlety and Purity of their *Waters*, especially when used in the way of *Bath* ; as we have found in

a Variety of Instances. And from many Discoveries of this kind, we are firmly persuaded, that *warm Baths* prepared of such sweet and subtile *Waters*, being used at proper Times and Seasons, will have the same Effects as the natural insipid *hot Springs*, that abound with no manifest saline or mineral Principle.

8. But as such soft and subtile *Waters* are not every where to be found, nor *Rivers* at hand in all Places, 'tis necessary that we shew some way of correcting and softening the *common Waters*, so as to fit them for medicinal Use. And this we judge may be most advantageously perform'd by a small addition of *fix'd alkaline Salt*; or otherwise by the Use of *Bran*, *common Camomile*, both the Herb and its Flowers; *Linseed*, *Pease-straw*, or *Oat-meal*: all which have the Power of taking off the Hardness of *Waters*, or rendering them soft and thin; so as to make them more easily enter the solid Parts of the Body.

9. We come next to explain the general *Manner* wherein *warm Bathing* acts. And first when the Body is plunged in a pure, light and simple *warm Water*, it undergoes this Change. The Heat necessarily rarifies and expands the Blood and all the Juices; and thus dilates the whole System of the Vessels. For 'tis the Nature and Property of all *Heat*, by the means of an extremely subtile, ætherial Matter, which it diffuses, to insinuate itself into Fluids, and increase their internal Motion, enlarge their Bulk, and therefore cause them to expand and rarify; as manifestly appears in the *Thermometer*. Upon this Dilatation of the Blood, the Pulse, or contractive Stroke of the Arteries, increases; whence the Blood circulates

*How
warm
Bathing
acts.*

with greater Force, and the external Parts of the Body become red, and begin to sweat.

10. The Body suffers another Change from the Gravity or Pressure of the *Water*. This Pressure is known, from Geometry and Mechanics, to be eight hundred times greater than that of the Air; whence 'tis no wonder if the Body plunged in *Water*, be greatly altered; as its Surface in that Case sustains a violent Pressure, which squeezes the Blood forcibly inwards upon the *Viscera*. Thus whilst the Vessels are compressed from without, and dilated from within, the intestine Motion of the constituent Parts of the Blood is increased: and consequently the viscid Juices are thus dissolved; Obstructions overcome; and the Humours the better fitted to pass thro' all the secretory and excretory Ducts. And as, by the *Water's* Gravity, the Parts are compressed from without, and the Blood driven plentifully upon the Heart, the Lungs, the Brain, and the larger Vessels; hence appears the Reason why, if the *Bath* be too hot, it causes Palpitations of the Heart, Oppression in the *Viscera*, or sometimes Fainting: and again, why, when the Body is foul or full of bad Juices, it produces continued Fevers; or inveterate Intermittents, if the first Passages abound with Crudities. These ill Effects are frequently observed in those *hot Springs* which have also an astringent Quality; as the violently hot *Caroline Spring* evidently has: insomuch that by Bathing therein, whilst the *Water* continues over-heated, it produces Fevers of all kinds; and frequently such as are dangerous.

How
warm
Bathing
cures Dis-
eases.

11. Another Change ensues upon the Body from the Moisture of the *Bath*; which, assisted with a temperate Heat, procures a great
Sup-

Suppleness to the Skin, and Fibres: insomuch that upon coming out of the Water, the whole Habit of the Body swells considerably, is loosened in its Texture, and opened in its Pores, and Vessels; whilst the Blood and Juices have a more free Passage to the Surface. And hence it is, that if a Person goes directly out of the *warm Bath* to Bed, he presently begins to sweat plentifully: which is the best Effect that can proceed from Bathing; and of great Service in the Cure of Diseases. It is therefore manifest, that the more subtile and light the Water of the *Bath* is, the greater Effect it will have, in relaxing the Parts, contracted by spasmodic Disorders. And from this Relaxation, and Suppling of the stiff and contracted Fibres, proceeds the Efficacy of *warm Bathing* in the Case of shrunk, dry, emaciated and cold Limbs, the Palsy, great Weakness and Inability of the Parts, &c. And hence it likewise is, that the Abdominal Parts also being softened and suppled, by warm Bathing, the Delivery of Women thus becomes easier, and the Body, that was before costive, rendered soluble; the menstrual and hæmorrhoidal Flux recovered; and a Suppression of Urine cured: which are known Effects of *warm Bathing*.

12. But tho' the Effects of this kind are allowed manifest, 'tis questioned by some, whether *warm Bathing* can be serviceable in Disorders of the internal and remote Parts of the Head, Breast, and lower Belly. We assert the affirmative, upon the footing both of Reason and Experience. For as warm Bathing of the Feet, is of great Use in internal Diseases; such as the Head-ach, *Vertigo*, convulsive Asthma, dry Cough, hypochondriacal and hysterical

That warm Bathing is curative of internal Disorders.

Disorders, Palpitations of the Heart, &c. it may reasonably be expected, that Bathing more Parts of the Body in pure, *warm Water*, may be attended with greater Success. And in fact, we find the greatest Use of warm Bathing in those Distempers where, by a violent Contraction of the membranous Parts, the Blood is thrown upon others; and both the Blood and Juices are prevented from coming to the Surface of the Body, and driven back upon the *Viscera*: which is indicated when the Extremities of the Body are cold and shrunk, the Belly costive, the Skin dry, and insensible Perspiration and Sweat obstructed. For in this Case, the Habit of the Body being relaxed, its Texture opened, and the finer Vessels expanded; the Blood not only freely circulates on the Surface of the Body, but the Perspiration of the Skin is restored; and a great Quantity of Impurities made to pass thro' that widened Strainer. And hence, there is scarce a more immediate and assured Remedy, for removing Impurities, and cleansing the Juices, than *warm Bathing*, properly used: as it so successfully carries off all corrosive Matters, which being seated deep in the nervous and membranous Parts of the Body, occasion Pain, Spasms, or even Exulcerations; and discharges them at the open Pores, or fine Net of the Skin.

Useful
in the Venereal
Dis-Taint
case.

13. *Warm-Bathing* is likewise admirable for cleansing the Mass of Blood from the *Venereal Dis-Taint*: for there is not a more expeditious and appropriated way of discharging a Matter that, by its Subtility and Acrimony, lodges in, and preys upon the solid Parts, and thus Causes violent Symptoms in the nervous System, than by

by the Glands of the Skin ; which are the best and universal Out-lets of the Body : whence the *Venereal Disease* is seldom totally eradicated, without the Use of *warm Bathing*. All experienced Physicians know of how little Service, and yet how mischievous, that Method of curing the Venereal Disease is, which turns upon the Use of *drying Decoctions*, and *Mercurial Preparations*; whether intended to sweat or salivate; unless Care be taken to discharge all the malignant Humour out of the Body; particularly by the Pores of the Skin. We could here produce numerous Instances of Cases where, after *Mercurial Salivations*, and the Use of *Mercurial Preparations* in the way of Diaphoretics, and Purgatives, assisted by sudorific Decoctions, the Symptoms have been abated for a Season; but after a while unexpectedly returned, with greater Violence: because the Taint was not thoroughly discharged; but part remaining behind, gradually prevailed, and acquired fresh Force. But by nearly the same Course of Mercurials and drying Decoctions, together with a proper Use of *warm Bathing*, at due Intervals, the Cure has been compleated; and the virulent Matter entirely discharged from the very innermost Seat of the nervous Parts.

14. *Warm-Bathing* is likewise excellent in that cruel Disease, the *Hydrophobia*, arising from the Bite of a *Mad-Dog*; whereby the Patient is at once tormented with Thirst and the Dread of Water. The only known Remedy in this Case is *Bathing*; which was used by the Antients for that Purpose. Thus *Celsus* relates it as “ a Practice with some, after the Bite was received, immediately to plunge the Patient
“ into

In the Hydrophobia.

“ into a *Bath*, and there sweat him as long
 “ as his Strength would permit; being also
 “ careful to open the Wound, that the Poison
 “ might the more freely distil from it *, &c.”

A Physician of *Duderstad*, lately informed me, that a mad *Wolf* coming out of the Woods, bit several Persons, who died of the Bite; till at length, by the Advice of an ordinary Man, some of them made use of a moderately *hot Bath*; having first taken a Dose of *Venice Treacle*, and the *Fungus* of the Dog-rose: which Process being repeated every Day, the rest were freed from Danger. For *warm Bathing* becomes serviceable in this Case, by bringing the subtil Venom to the Surface of the Body, where it finds a free Exit. But here may arise a considerable Doubt, because the Antients used *cold Bathing* for the same Purpose; which, by shutting up the Pores of the Body, might seem to detain the Poison, and throw it upon the inward Parts. Our Opinion is, that *cold Bathing* should not be absolutely condemned in this Case; tho' it seems highly precarious and uncertain. However, if there follows upon its Use, a considerable Heat of the internal Parts, attended with a quick Pulse, and Sweating; which often happens; it may then be of Service: but if the Nerves become stiff and rigid by the Cold, it must needs be attended with Danger. And to prevent such an ill Effect, *Celsus* prudently advises to plunge the Patient in *warm Oil*, as soon as he comes out of the *cold Bath*.

In scorbutic and hypochondriacal Cases. 15. *Warm-Bathing* used with proper Caution, is also eminently serviceable in cleansing the Blood

* See *Cels.* Lib. 5. Cap. 27.

Blood and Juices from such scorbutic Foulness as Causes great Pains in the Limbs. The good Effect of the natural *medicinal Springs*, used both internally and externally, in this Case, is well known: But when these cannot be had, diluting, gently opening, and sweating Decoctions, with the Assistance of *warm Bathing*, at proper Intervals, may supply their place. It is scarce credible what a large Discharge of foul Humours is sometimes made by the Skin, into the Water of the *warm Bath*. To this purpose there is a remarkable History, in the *German Miscellanies*, of a Woman afflicted with a Pain in her Loins, who after trying other Things in vain, found nothing gave her so much Relief as *warm Bathing*; upon the Use whereof for a few times, she grew better; after a gross unctuous Matter was observed floating upon the top of the Water; that might be taken off with a Spoon*. There is also subjoined another History of an hypochondriacal Man, who, upon a little Use of the *warm Bath*, found the Water began to smell fetid; with a gross black Matter floating on the top, which daily grew more corrosive; so as to occasion a Necessity of fresh Herbs every Time, by Reason of the noisome Smell, and Acrimony of the Water, which affected the Hand of the *Rubber*: and this continued till, at length, the Patient was happily recovered†.

16. But

* *Miscellan. Natur. Curios. Decad. II. An. 6. Observat. 239.*

† When Persons apparently in Health use the warm Bath, 'tis easy to observe a Quantity of unctuous Matter floating upon the Surface of the Water; which being admitted into the Mouth tastes very disagreeably to the Person bathing. And the Waiters at *Bagnio's* know what great Quantities of filthy unctuous Matter come from the Body in the *warm Bath*.

*Efficacy of
warm
Bathing in
the Cure of
Madness.*

16. But one of the capital Uses of *warm Bathing* is to cure such Diseases as firmly seat themselves in the upper Parts of the Body. An eminent Instance of this we have in maniac Disorders; whether attended with Sadness or Raving: for Relief wherein, *warm Bathing* is extremely useful. The Persons subject to these Disorders are such as have the *Hypochondria* affected, or the nervous Parts of the lower Belly spasmodically bound and contracted: which is a Case attended with Costiveness, a great Constriction and Coldness of the Skin, and a gross and foul Mass of Blood, forcibly driven upon the Brain. For if the Blood be copiously collected in the Vessels of the membranous Parts of the Brain, and flows therein with Difficulty, it occasions numerous, terrible, and phantastic Apprehensions. But if in certain Constitutions there be, as it were, a particular Fever in the *Meninges* of the Brain; when the Blood runs violently thro' the Vessels thereof; it thus causes Raving, and such disorderly and furious Motions in the Patient, as render it necessary for him to be chained; to prevent his injuring others. The noble Effects which *warm Bathing* has in these Cases, is owing to nothing more than its softening, suppling and relaxing the nervous Parts, opening, by its Warmth and Moisture, the cold and hardened Skin, and thus deriving the Course of the Blood upon the Habit of the Body; and giving it a free and general Circulation. It is not, however, from Reason alone, but from a long course of Experience, that we assert the Excellence of this Remedy, in these Cases: For we have seen numerous Instances, both of inveterate melancholy, and raving *Madness*, happily

pily cured by its Means; after the Use of Bleeding, diluting Medicines, and Medicines consisting chiefly of *Nitre*. And this kind of Cure I have recommended to many foreign Physicians, who, as well as my self, find it highly serviceable and beneficial. Whence I have often wondered that this Method of Cure for Madness, should be so much neglected in our Time; whilst Bathing has, from the earliest Ages, been employed for this Purpose: inso-much that the antient Physicians had recourse to it as a Thing they entirely depended upon. This will manifestly appear to those who consult *Trallianus* *, *Aretæus* †, *Cælius Aurelianus* ‡, and *Prosper Alpinus* §.

17. *Warm-Bathing* also proves very serviceable in other *Diseases of the Head*; as deriving the Blood and Juices from thence to other Parts, even the external ones, by its Warmth and Moisture; which softens and relaxes them. Thus in the *Epilepsy*, which in Women arises from a Suppression of the menstrual Flux, we have known *warm Bathing* used to Advantage, along with other Remedies. And *Trallianus* highly recommends it in this Distemper, to be used twice or thrice a Week, and rather before, than after Meals **. But the *Bath* must be refrained near the time the Fit is expected, lest thro' the Pressure of the Water upon the lower Parts, and the Expansion of the Humours by the Heat, they should flow to the Head, now weakened and rendered unfit to receive them: whence a Fit might be hastened, and

*And other
Diseases of
the Head.*

* Alex Trallian. Lib. I. pag. 107.

† Aret. Lib. VII. pag. 134.

‡ Cæl. Aurelian. Lib. I. Morb. chronic. pag. 555.

§ Prosp. Alpin. de Medicin. Ægypt. pag. 115.

** Trallian. pag. 74.

and made more violent ; but there is no Danger in using this Remedy at proper Times in the Interval of two Fits. We likewise find *warm Bathing* advantageous in severe obstinate Pains of the Head, the *Vertigo*, short Distractions, proceeding from the hypochondriacal Disease ; and in spasmodic Contractions of the lower Belly : For thus the *warm Water* not only derives the Motion of the Humours to the lower Parts, but also mollifies and relaxes the Contractions which cause these Disorders. So likewise in the *Epiphora*, sharp Defluxions, and Inflammations of the Eyes, *warm Bathing* is of singular Efficacy.

The Efficacy of warm Bathing in the hypochondriacal Disease.

18. But there is no Case wherein this Remedy proves of greater Service than in the hypochondriacal Disease ; which is not only a stubborn, but also a reigning Evil, at this Time ; being commonly attended with a grievous Train of Symptoms, without Intermission ; and causing great Perplexity to Physicians, who have not hitherto discovered its perfect Cure. To speak the Truth, there is no better, or more effectual Remedy, for relieving and eradicating this Distemper, than a proper Use of the *hot and cold mineral Waters*. But here we must observe that *Bathing* in the purest, and lightest Water, wonderfully seconds the internal Use of *Medicinal Springs*. For those Waters which are properest in Drinking, as containing a considerable Proportion of a heavy, earthy, and saline, or astringent, irony Matter, are not so proper for the purpose of Bathing, in this Distemper, as the purer. This has been confirmed to me by long Experience of the hot *Caroline* astringent Spring. And hysterical Women receive the same Advantages from *warm Bathing* as hypochondriacal Men.

19. To

19. To discover the reason of the noble Effects of *warm Bathing*, in these Cases, we must first examine into the Seat, the Origin, the Nature, and the Symptoms of the hypochondriacal Disorder. And when all things are considered, it certainly appears to reside in that nervous and membranous Tube, wherein the Aliment is digested, dissolved, and discharged; that is, in the Stomach and Intestines; the peristaltic Motion whereof, which naturally consists in a reciprocal Dilatation and Contraction, is plainly disturbed, or even inverted. And this chiefly proceeds from certain spasmodic and convulsive Contractions; whereby, if the lower Parts of the Intestines are affected, especially when full, the Excrements are not only detain'd in the Tube, but Flatulencies, or windy Vapours, generated and pent up; so as to rise, and violently distend the smaller Guts and the Stomach. And thus all the nervous Parts, endowed with an exquisite Sense, are, by what the Antients call *Consent*, drawn into a similar spasmodic Motion; whence proceed that numerous Train of Symptoms which afflict nearly all the Parts of the Body. If this Disorder has only a transient Cause, not seated in the Substance of the *Viscera*, it receives an easy Cure by proper Remedies. But if it also seizes upon the *Viscera*, especially the *Pancreas*, the Liver, the Spleen, or the Mesentery; and the Coats of the Intestines be injured, and destroyed; a thorough Cure is very hard to effect: for the Case is rather exasperated, and at length sometimes rendered incurable, by a frequent Change of Physicians, and Medicines; with which People in this Distemper vainly amuse and deceive themselves. From hence every Physician will perceive,

*The Seat
and Na-
ture of the
hypochon-
driacal
Disease.*

*The
warm
Bath pro-
per for the
hypochon-
driacal
Disease.*

perceive, that of all Remedies none is so efficacious as a warm, innocent Fluid, properly used, both externally and internally, for restoring the natural Tone or Tension of the intestinal Tube; easing and relaxing the spasmodic Contractions of these Parts; and re-inflating the inverted peristaltic Motion; or directing it to its natural Tendency downwards. For thus, by its agreeable Warmth, it gently mollifies and relaxes the hardened and crisped Fibres, recalls the Blood and Humours that were before excluded, and causes a free Circulation of the Juices thro' the Vessels of the Intestines. And this Virtue of *warm Water* was not unknown to *Hippocrates*; who says expressly, that "it softens and supple the Skin, "eases Pain, relaxes Contractions, Convulsions and Distentions; and cures Heaviness of the Head*." And by the same Property it is that *warm Bathing* cures all such Distempers as proceed from a Contraction and Spasm of the Parts of the lower Belly. Of this kind are Pains in the Intestines, Gripings, violent convulsive Colics, heavy Pains and Contractions occasioned by the Stone in the Kidneys; and attended with Suppression of Urine, Costiveness, &c. in all which Cases the *warm Bath* is eminently serviceable. It must however be observed in the convulsive Colic, proceeding from a Stagnation of the Blood, if the Body is full or overcharged with Juices, *warm Bathing* becomes unsafe; except some Blood be first taken away†. But in such Colics as proceed from Hardness of the Excrements, a *Bath* prepared with emollient Ingredients, is highly serviceable, along with proper
laxative

* Aphorism. 22. Sect. V.

† See Trallian. Oper. pag. 591.

laxative Medicines; such as *Oil of sweet Almonds*, *Manna*, *Epsom Salt*, *Cream of Tartar*, &c. This kind of Bathing also deserves to be recommended in the *Iliac Passion*; especially if a Portion of the *Ileum*, confined in the *Scrotum*, be the Cause thereof: for if any thing can contribute towards re-placing that Intestine, whilst fill'd with Flatulencies and Excrements, there will scarce be found a more assured Remedy than the *warm Bath*.

20. *Warm Bathing* is likewise peculiarly adapted to ease the Torture, proceeding from a *Stone in the Kidneys*. For if the Stone, lodged in the slender Conduits of the Urine, be somewhat large, it occasions spasmodic Contractions; not only in the Passages of Urine, but in all the nervous Parts of the Body. In this Case therefore nothing is more advisable than to detain the Body in a temperate Bath; by the Warmth whereof, the Contractions of the Parts will be relaxed; so as not only to mitigate the Pain, but likewise promote an easier Exclusion of the Stone, thro' the Canals that are now suppled and widened, to admit thereof. And this Remedy, for the present Purpose, is not only found effectual in our Age, but was also recommended by the antient Physicians *. And with regard to the Use hereof, we have observed, that when a very large Stone sticks in the Cavity of the *Urethra*, it occasions a violent Pain about the *Os Pubis*; but this Pain is not at all felt, so long as the Patient remains in the Bath. Particular Care must however be had, not to advise the Bath too hot in Cases of the *Stone*;

Effect of
warm
Bathing
in the
Stones

* See Alex. Trallian. pag. 543, 547, 551. A.ët. pag. 118.

especially if the Body be full of Blood, youthful and florid: otherwise a Fever might easily be occasioned, as Experience testifies.

*Whether
the warm
Bath be
proper in
Fevers.*

21. 'Tis a Question of great Moment, whether *warm Bathing* be serviceable in *Fevers*; especially Intermittents. The Antients, particularly *Hippocrates*, *Galen*, *Celsus*, and the *Methodists*, held the Use of Bathing in great Esteem, for the Cure of Fevers; especially Intermittents: and this chiefly in the Interval of two Fits, or when the Fit was going off; or even in the beginning of an ardent Fever*. Upon consulting such of the Antients as have wrote upon this Particular†, and comparing them with Experience, we find reason to assert that *Bathing* is very serviceable, being used the Day after the Fit of an Intermittent; and again when the first Passages have, by means of opening and relaxing Salts, been thoroughly cleansed of their Impurities. For the corrupt Humour, which causes Fevers, cannot with greater Safety be discharged the Body, than by relaxing the Skin; especially if a sweating Medicine be taken before going into the *Bath*. But when the Fit is approaching, or actually come on, *Bathing* must be refrain'd, as improper; according to the Direction of *Hippocrates*‡. The same Remedy is likewise very serviceable in the Decline of an Intermittent||. *Platerus* also, advantageously used *warm Bathing*

* See Trallian. pag. 543, 547, 551. and Aret. pag. 118.

† See Galen. Method. Medend. Lib. VIII. cap. 3. Alpin. de Medicin. *Ægyptior.* Trallian. Lib. XII. pag. 735. Galen. Lib. de Therap. Cels. Lib. II. Cap. 17. & pag. 105.

‡ De Morb. Mulier. pag. 151.

|| See Cels. pag. 105.

ing in a Quartan, on the Day before the Fit*.

22. We add, that the Operation of other noble Remedies is wonderfully forwarded and promoted by *warm Bathing*; so as to render them productive of much greater Effects. Thus, according to our Opinion, and Experience, 'tis seldom proper to direct a Course of Mercurials, with Intention to salivate, or to sweat, either in the venereal Disease, or other obstinate Cases, without interposing the Use of *warm Bathing*: for this so softens and relaxes the Skin, and opens the Pores, that the corrupt Humours cannot, with such Violence, fall upon the Jaws, or other Parts; but are in great measure dislodged from their innermost Seats, and discharged, thro' the cuticular Strainer: whence, under such Regulation, a Cure may be very safely and advantageously prosecuted with *Mercurials*. The Antients, who had no Knowledge of any chemical, or other very powerful Remedies, made use of *white Hellebore* in obstinate Cases; but scarce ever prescribed it without directing the *warm Bath* first: which not only liquifies the Blood and Juices, and renders them more moveable; but also opens the Passages, for the better Discharge of the peccant Humour. And in this manner there was no great Danger of producing any violent Symptoms, by the Use of such rough Purgatives as operate by spasmodical Contraction. Thus likewise, Steel Medicines have a considerable Efficacy in the Cure of chronical and hypochondriacal Disorders; but to prevent such Remedies from proving mischievous, it is highly proper to use *warm Bathing* between whiles; whereby the offending

That warm Bathing forwards the Operation of other Remedies.

Humours are the better prepared for Dislodgement and Exclusion. And no question but the *Bark*, and other astringent Remedies, of use for putting by the Fit of an Intermittent, may be given with much greater Safety, under a proper Course of *warm Bathing*.

*Rules for
Bathing.*

23. For a Conclusion, we shall lay down a few Rules to prevent the *warm Bath* from proving prejudicial. And (1.) it should never be used too hot, but always temperate; in which State it must be constantly kept all the time, by the gentle Addition of *hot Water*, to prevent its cooling. (2.) Where the Body is full of Blood, or abounds with ill Juices, the *Bath* should never be used, before some Blood is taken away; or the proper Evacuations made, by gentle Purgatives, or otherwise. (3.) The most suitable time for *Bathing* is the Morning, when Digestion has been perform'd, and the Stomach remains empty: and more particularly when the Body is not costive. (4.) Lastly, the Person must not stay in too long, for fear of weakening the Body: and when he comes out, he should go directly to Bed; to prevent taking cold, and to promote a plentiful Discharge by Sweat: which may be forwarded by the drinking of any proper warm Broth, or Decoction.

S E C T.

S E C T. VII.

*Of the Ways of imitating MINERAL WATERS,
so as to supply the Decay, Failure, and
Want of particular SPRINGS.*

1. **A**S it is made evident by the preceding *Whether*
Sections, that *Mineral Waters*, for the *Mineral*
Prevention and Cure of Diseases, have no *Waters*
known Remedy comparable to them; as *are imi-*
all Persons cannot have the Opportunity of *table by*
frequenting the *Wells*; and as the *Springs* them-
selves are sometimes, tho' rarely, subject to
Decay; it becomes a Question of Importance,
Whether, from a Knowledge of the Prin-
ciples and Ingredients of these Waters, they
may not be imitated by Art; or the more
common Waters of every Place, be impregnated,
so as to produce the same Effects? Many Che-
mists of the last Age held the Affirmative; and
in particular imagined, that *cold Mineral Springs*
were easy to be imitated. But they certainly
went upon a false Notion; which with many
prevails to this Day; that these *Waters* owed
their principal Virtue to a *Vitriolic Substance*;
and thence imagined, that they needed but
dissolve such a Substance in pure *Spring Water*,
and the thing was done. But upon Trial they
found their Error; for there is no solid *Vitriol*
contain'd in these *Waters*. Nor is there a single
Instance of a *Spring*, that we know of, holding
a Salt, so far like that of *common Vitriol*, as
when dissolved in *Water*, to turn inky with
Galls; make a *neutral Salt*, or *Tartarus Vi-*
triolatus, with *Oil of Tartar*; and upon eva-
porating,

porating, leave behind a Concretion, that when ground with Nitre, yields the Fumes of *Aqua fortis*.

Founda-
tion of the
Thing.

2. To lay a Foundation for a more successful Imitation of *Mineral Springs*, we must observe, that there are some, both of the *hot* and *cold* kind, which contain no *saline* or *mineral Principle* at all ; and are nothing but a very pure, subtile, and light *Water* : which, however, has very considerable medicinal Virtues. If such *Spring Water* as this be not procurable ; we may, perhaps, to as good Advantage, use, in its stead, the purest *Rain Water* *.

To imitate
pure Iron
Waters.

3. There are certain *Springs*, of a very light and subtile *Water*, containing no earthy or *saline Principle* ; and only a small Quantity of an irony Substance : and these may properly be called *Iron Waters* ; for they exhibit no Change to the Eye upon the admixture of *Acids* or *Alkalies* ; but by standing, or being heated, deposite

* As the Uses of a pure *Rain Water* are numerous, and extensive, it might be worth considering how to obtain it in Plenty and Perfection. Could not Country-Houses be built flat, or concave, on the Top, and with a general Current, so as to catch, and discharge the *Rain* that falls, like a Funnel, into a proper Reservoir ? Or, were it not expedient to have some little flat Buildings, or *Rain-Water-Houses*, for this Purpose, near large Towns ; with a Superintendant to distribute this useful Fluid ? It were easy to contrive a way of excluding all manner of Filth or Foulness from the Tops of such Buildings, their Conduit-Pipes and Reservoirs ; and only uncover them at the time of Rain. And if Men were but convinced of the Benefit and Extent of such a Design, they would not, perhaps, be long before they reduced it to Practice. The Family Uses of such *Water* are known to many ; but its Sweetness, Wholesomeness, medicinal Virtues, both internal and external, its Suitableness to the making of *artificial mineral Waters*, its Uses in Pharmacy, Chemistry, and other particular Arts, are known but to few.

deposite a yellow okery Sediment. It is, therefore, no Difficulty to imitate this kind of *Water*, by Art; where a sufficient Quantity of a pure, light and simple *Water* is at hand. The Method is only to boil it, in a Glass Vessel, with a little of the more curious and subtile Oker sold in the Shops; by which means the *Water* will acquire a like Virtue, when used both internally and externally, as those of the natural *Iron-Springs*.

4. There are other *Springs*, remarkable for the Lightness and Subtily of their *Water*; which, besides a small Proportion of Iron Oker, hold a considerable Quantity of common Salt; whence they derive their principal Virtue. These *Waters* are somewhat purgative; and advantageously used in the way of Bath. They suffer no apparent Change upon mixing with Acids, or Alkalies; and do not abound with a mineral elastic Spirit. Such *Waters*, therefore, may commodiously be imitated by dissolving a little *Sal Gem* in the above-mentioned natural, or artificial, *Iron-Water*.

5. The Imitation of the cold and brisk *Mineral Springs* is attended with greater Difficulty; if we would prepare them in such a manner as to have the natural, quick and pungent Taste, Smell, and copious elastic Spirit. I have, however, attempted to imitate them, by adding to the finest simple *Water* I could procure, contain'd in an earthen Vessel, with a narrow Neck, first, a little highly calcin'd and dissolved Salt of Tartar, next a little Spirit of Vitriol, so as to make an Ebullition; yet suffer the alkaline Principle to predominate; then shaking the Vessel, whilst it remain'd close stoppt. By this means I obtain'd a *Water* resembling the natural,

To imitate
the saline
Iron Wa-
ters.

To imitate
those call'd
Acidulæ,
and the
Pymont
Waters.

natural, in Taste, and that threw up numerous Bubbles, in pouring out. It likewise answered the natural *Water* in its Virtue, and Effects; so that I have given it, with great Advantage, in such Distempers as required the drinking of the moderate, brisk, and cold *Mineral Waters*; where the natural ones could not be procured. But if the Design be to imitate the *Pyrmont Steel Waters*, which abound with an Iron Oker; either the natural or artificial *Iron Waters* should be chose for the Purpose, and a somewhat larger Proportion of *Salt of Tartar*, and *Spirit of Vitriol*, be used; but so that the Alkali may still prevail*.

6. There

* There are Reasons to apprehend, that either this Expedient, or a worse, is practised at *London* and elsewhere; so as to imitate the *Spaw*, the *Pyrmont*, and other foreign and domestic *Waters*, in such a manner as to pass undiscovered upon ordinary Judges. If these Dealers had Art enough to make their Imitations perfect; the Deceit were the more tolerable: But as they commonly manage it, every Drinker who cannot procure the genuine, had better make the artificial himself, fresh as he wants it; which he may do by the Help of these Directions. And to those who are curious in this particular, we recommend the purest *Rain Water*; and instead of *Spirit of Vitriol*, the true *Spirit of Sulphur*; which is with Fidelity, Exactness, and a particular *Encheiresis*, prepared, and sold cheap, by Mr. *Joseph Clutton*, Apothecary, in *Holborn, London*. But for a Method of imitating these *Waters*, which comes still nearer to that of Nature; we think proper to intimate, that many Experiments and Observations shew the mineral Spirit, the specific Virtues, and irony Principle of *Steel Waters*, to proceed from the *Pyrites*, dissolved by such *Waters under Ground*. Whence, perhaps, Beds of these *Stones* might be laid in the Course of a pure *Spring*; so as to grow hot, steam, and richly impregnate the *Water* that runs near them; without turning to *Vitriol*. The Experiment is recommended to the Skilful in Chemistry, and natural History.

6. There are besides these, certain *Purgative*, *To imitate Mineral Waters*, which tho' they make an E-<sup>the Purg-
ing Wa-
ters.</sup> bullition with Acids ; yet leave a *bitter, neutral Salt* upon Evaporation. These *Waters* are to be imitated in the same manner, by the means of *Oil of Tartar*, *Spirit of Vitriol*, and *Epsom-Salt*; or that prepared from white *Manganese* and *Spirit of Vitriol*. And much after the same way may be artificially prepared a *Water* abounding with an exquisite *neutral Salt*; and capable of purging very effectually. The way is to dissolve, in the purest and lightest simple *Water*, a suitable Proportion of *Glauber's Salt*. Or a still better Method is by mixing *Oil of Vitriol* with the *white Manganese*, so as to obtain from that calcarious Earth, and the vitriolic Acid, a Salt, after the same manner as it is prepared by Nature ; and then dissolve this Salt in the pure *Water*, so as to equal the Proportions of that proposed to be imitated: for example, in the Quantity of about two Drams to twelve Ounces*.

7. Lastly, if any one desires to imitate the *Caroline Waters*, which are extremely alkaline, <sup>*To imitate
the hot
Well Wa-
ters.*</sup> and somewhat purgative ; he should endeavour to procure, not a light and subtile *Water*, but such as is loaded with a calcarious Earth ; and drop into this, first the *Spirit of Vitriol*, and afterwards the Solution of *Salt of Tartar*, till the alkali manifestly predominates. The *Spirit of Vitriol* should be first poured in, that it may lay hold of the calcarious Earth ; and therewith turn into a *neutral*, and somewhat *purgative Salt**.

8. These

* To make it equal the Strength of the *Sedlitz Waters*; which are much stronger than those of *Epsom*.

* These Imitations confirm the Practicability and Certainty of determining the Principles, Contents and Virtues of *Mineral Springs*, by a proper chemical Analysis ;

8. These are the ways I have my self tried, to imitate the natural *Mineral Waters* for internal Use. And upon examining the Principles and Contents of these *artificial Waters*, they appear to hold not only the grosser *earthy* and *saline Substances*, but also something extremely like the curious elastic mineral Principle of the natural Waters; proceeding from the Action and Re-action attending a state of Effervescence *. They likewise, upon Trial, appear to have great medicinal Virtues; so as to be, with desirable Advantage, exhibited for cleansing the Blood, and curing numerous Diseases, according to their several Intentions: Tho' I cannot positively say, nor will pretend, that they come up to the Excellence of the *natural Waters*.

To imitate
the natu-
ral Baths.

9. It remains that we shew a Method of preparing *simple Waters*, for external Use, so as to supply the want of *Mineral Springs*. We formerly intimated how, by the Addition of *Salt of Tartar, Pot-ash, Flowers and Herbs*, whole-

Analysis; and indicate the Means even of improving upon Nature. At least, if a Person be tolerably versed in Chemistry, and the Business of Experiments, it will not be difficult to assign, *a priori*, the Virtues and Uses of any *Water* proposed; whence it might not, perhaps, be amiss, if a few Persons, thus qualified, were employed in *discovering and examining the Mineral Waters of England*, for a public Benefit. Something of this kind was intended by the *Royal Academy of Sciences at Paris*; as we learn from the *Sieur du Clos*: and the Attempt indeed was worthy of them, but the Performance very defective.

* We before intimated pag. 33. that the natural *Medicinal Springs* appear to have a kind of *Effervescence*, or what we vulgarly call *Fermentation*: and upon an analytical Comparison, there will be found a considerable Affinity betwixt some *Wines* and the brisk *Mineral Waters*.

wholesome *Baths* may be commodiously prepared ; and shall therefore, in this place, touch upon such as may be made by the Means of *Metalline Scoriæ*. The most common and useful of this Kind are those prepared with the *Scoria of Iron* ; which abounds with the earthy, saline and sulphureous Substance of the Metal. And these are of excellent Service for strengthening and bracing up the Parts, and recovering weak and decayed Limbs ; stopping various kinds of Bleeding, and restoring the menstrual and hæmorrhoidal Flux, where obstructed ; insomuch, that they may well be substituted for the natural *Iron-Baths*.

10. Adjacent to the *Smelting-Huts*, where Metals are run from their Ore, are to be found large Quantities of the *Slag of Copper, Antimony, and Cobalt* ; which abounding with Sulphur, vitriolic Salt, and an earthy Principle, make serviceable *Baths*, for strengthening the lost Tone of the Fibres, and relaxing them when they are too crisp. These *Baths* have likewise a deterfivè and cleansing Virtue ; so that, with Prudence, and a due Regard to Circumstances, they may be used on many Occasions. The way of making these *artificial Baths*, is either to take the Slags, as they come hot from the Furnace, or else to heat them afresh, and throw them into hot *Water*, contained in a close covered Vessel ; that they may communicate their Virtue to the *Water* ; which is afterwards to be used either in the way of *Bath*, or Fomentation, occasionally.

To conclude, There are other *artificial Baths* prepared of *Alum* and *Quick-Lime*, by boiling them together in fine Rain Water ; and such Baths are highly serviceable in paralytic Disorders, and Weakness of the Limbs.

APPENDIX:

Containing a PLAN for the Particular Examination of the *Mineral Waters* of *England*.

*Whether
the Virtues
of Medici-
nal Wa-
ters are
determina-
ble à prio-
ri.*

1. **A** PRINCIPAL View in publishing this *Treatise*, is to shew an easy Method of examining *Mineral Waters*; in order to determine their Medicinal Virtues, *à priori*. For tho' Mr. *Boyle* suspected such a Thing almost impossible; yet whoever understands the preceding Discourse, will find Reason to hope more favourably.

2. But as the Authority of so judicious and experienced a Writer has, contrary to his Intention, rather discouraged, than promoted a full Enquiry into this useful Subject; it may be proper to consider the Passage it self: Which runs thus. “ But here I must ingenuously own to you, that notwithstanding the many ways I propose of discovering the Natures or Qualities of *Mineral Waters*; yet I think the surest way of knowing them, is a long and sufficient Experience of their good and bad Effects. For I strongly suspect, and, it may be, partly know, that there are, beneath the Surface of the Earth, divers Mineral Substances, some fixt, and
“ some

“ some volatile, some in the form of hard
 “ Bodies, some of soft ones, some of Liquors,
 “ and some of Fumes, divers of which the
 “ generality, even of learned Men, are alto-
 “ gether Strangers to ; besides those that, tho’
 “ some Men may chance to have seen, have
 “ their Natures so little known, that they
 “ have not so much as Names assign’d to them.
 “ So that when I consider that of the Ingredi-
 “ ents we are acquainted with (to pass by all the
 “ rest that the Earth may conceal) the Propor-
 “ tions wherein they are mingled may be num-
 “ berless, and the Qualities resulting from
 “ these Commixtures may be very differing
 “ from those of the separate Ingredients, *I am*
 “ *apt to look upon the Difficulty of securely de-*
 “ *termining the Effects of Mineral Waters à*
 “ *priori, as little, if at all less than insupera-*
 “ *ble, to human Understandings*.*

3. From a Misconstruction of this Passage,
 many have been discouraged from attempting
 to discover the medicinal Virtues of *Mineral*
Waters, à priori. It is true, there are nume-
 rous Mineral Substances contained in the Earth ;
 but how few of them are capable of intimately
 mixing with Water ; how few of these may
 lie in the Course of any one *Spring* ; what an
 Appetite of Choice and Rejection, or Power
 of Attraction and Repulsion, there is between
 Waters and Minerals, may be worthy the En-
 quiry. If indeed *Water* was an universal Sol-
 vent ; this would increase the Difficulty : but
 that is far from being the Case. Water does
 not dissolve Gold, Silver, Lead, Tin, Gems,
 Pearls, Shells, Glass, and numberless other
 Bodies,

* Memoirs for the Natural History of *Mineral Waters.*
 pag. 3, 4.

Bodies. Even in the dissolving of Salts its Power is limited ; and can by no means act upon Things that lie out of its Reach : as infinite Mineral Matters do out of the Course of particular *Springs*.

4. Besides, there are, in Fact, abundance of Experiments that discover, with Certainty, very minute Proportions of nearly all the Bodies that Water seems capable of dissolving ; either in the Earth, or out of it. And these Experiments evidently shew that *Mineral Waters* naturally contain but a few of the Matters lodged in the Bowels of the Earth ; even of such as lie in their Passage. And what adds greater Confirmation hereto, we can with a few Materials imitate, almost to Perfection, all the natural *Mineral Springs* hitherto discovered ; as may in good measure appear by the preceding *Section* upon that Head.

5. Again, the Difficulty of determining the Virtues of *Mineral Waters*, *à priori*, lies not so much on the side of the *Waters*, as on the side of the human *Body*, and its Diseases ; which for want of a proper *Set of Observations* are not sufficiently understood. However, *Mineral Waters*, in this respect, stand upon a surer footing than the common Medicines of the Shops ; on Account of their greater Simplicity, Innocence and superior Virtues. For it must be allowed, that more extraordinary Cures, in obstinate chronical, and reputed incurable Diseases, have been effected by *Mineral Waters*, even tho' empirically employ'd, than by the common Shop Medicines.

6. Lastly, If the same plain Sense be used in the *Examination of Mineral Waters*, as in the common Affairs of Life ; the force of the Objection will amount to very little. Thus, for Instance,

Instance, if a Liquor be offered to a Person under the Name of *Wine*; he views it, smells it, tastes it, and if it be *Wine* to his Senses, he makes no Scruple to drink it. But if there be ground of Suspicion, that it is not *Wine*; he may perhaps analyse it, separate its inflammable Spirit, its Water, its Tartar, its *Media Substantia*, and its Earth: and if it sustains all these Trials, he must pronounce it *Wine* in all its Forms. So, if an unknown *Water* be offered, we first examine it by the Senses, and find it, perhaps, pungent to the Nose, irony to the Taste, and capable of staining the Glass yellow; which are Indications of a *Steel Water*. And if upon farther Examination the proposed *Water* shall, by its bubbling in the open Air, or in *Vacuo*, or by Distillation, be found to contain a fine Mineral Spirit; and by Evaporation a fixed Salt, a light irony Earth; and nothing more, besides the merely aqueous Part; who would scruple using this *Water* as an actual *Steel Water*; and not venture to pronounce it diuretic, strengthening and restorative? Whence the Qualities and Virtues of *Mineral Waters* appear as securely determinable *à priori*, as the Wholesomeness of common *Waters*, *Malt-Liquors* or *Wines* *.

7. Upon the whole, it appears that we are to understand the Words of Mr. Boyle above quoted, rather as a *Suspicion* than a *Certainty*; and should not wrest them to a Discouragement of any farther Attempts to examine *Mineral Waters*; for which they were never intended: as appears by the very next Paragraph; where
the

* If any one shall still retain a Suspicion that the *Natural Mineral Waters* are uncertain in their Ingredients, he may use the *artificial*; the Contents whereof being certainly known beforehand, can leave no room for Objection.!

the Author adds, “ But this Difficulty is not
 “ such as ought to make us think it useless
 “ to have a good Project of the natural His-
 “ tory of *Mineral Waters*. For it is no small
 “ Advantage, to know what Particulars are
 “ fit for our Enquiry, to be furnished with a
 “ Set of Heads, to which one may convenient-
 “ ly refer whatever he tries, or observes, about
 “ the Subject proposed ; and (what is yet
 “ more considerable) to be furnished with va-
 “ riety of Methods, or Ways, to make Trials,
 “ fit for investigating the Nature, or examin-
 “ ing the Qualities, of the proposed Water ;
 “ since by the Number and Variety of pur-
 “ posely and fitly devised Experiments, he
 “ that makes them may, as it were, view his
 “ Subject on all Sides, and be much assisted
 “ to conjecture, what saline or other Mine-
 “ rals known to us, and what Quantities of
 “ them, do impregnate the Water he exa-
 “ mines ; and consequently what Effects they
 “ are like to produce in Human Bodies *.”

And his own excellent Enquiries are a suffi-
 cient Encouragement for us to proceed upon the
 same Experimental and Rational Foundation.

*A necessity
 for re-exa-
 mining the
 more sa-
 mous Mi-
 neral Wa-
 ters of
 England.*

8. If this might in any measure remove
 what seems to have been a great Obstacle, with
 the more Judicious, to a thorough Enquiry
 into *Mineral Waters*, we may proceed to the
 Business of this *Appendix* ; and lay down a *Plan*
for a Practical Examination of the Mineral Wa-
ters of England. The Advantages of such an
 Examination 'tis conceiv'd would be nume-
 rous, and lead not only to the Discovery and
 right use of perhaps the safest, and most ef-
 fectual set of Remedies in Nature ; but also the
 Dif-

* *Memoirs for the Natural History of Mineral Waters,*
 pag. 4, 5.

Discovery of Mines, and many mineral Matters, of Use in Trades and Manufactures.

All that has hitherto been done upon the Subject, in *England*, cannot exempt the medicinal Use of *Mineral Waters* from the *Opprobrium* of an Empirical Remedy; nor ever will, so long as the Principles of such *Waters*, the particular Cases and Constitutions whereto they are adapted, and the Methods of using them, are barely guessed at; and not understood. So that there is still wanting a *particular Examination of every Mineral Spring in the Kingdom, to shew its Contents, real Virtues, and respective Uses in Physic; with a particular View to render such Waters a rational Remedy.* It is therefore requisite to re-examine all the more famous *Mineral Waters of England*, hitherto discovered; at least in as exact a manner as Dr. *Hoffman* has done those of *Germany*. Thus, in particular, the Waters of *Bath, Bristol, Tunbridge, Scarborough, Buxton, &c.* should be carefully examined afresh. For till some more solid Discoveries have been made of these *Waters*, so as to regulate and direct their proper Uses, with tolerable Certainty; we must give the World leave to call them *Empirical Medicines*.

If it be said, that we have numerous Descriptions of these Wells already extant, by very eminent Hands; let it be considered how few of them were qualified for a Work of this kind; and how few solid Discoveries they made, for want of a *Talent at Experimenting*: tho' it may not be amiss to compare the new Sets of Experiments with theirs, and to note the Differences and Occasions thereof*.

9. But

* With this View it may be proper to consult the following Writers, viz.

Carolus Clarmontius de Aëre, Solo, & Aquis; deque Mor-
P lis

The
Springs
lately dis-
covered, re-
quire a
farther
Exami-
nation.

9. But besides the *Mineral Waters* of Re-
putation, there have lately been discovered se-
veral

*bis Anglorum vernaculis ; una cum ejusdem Observatoribus Me-
dicis Cambro-Britannicis.*

The Scarborough Spaw, spagyrically anatomiz'd, by
Dr. Tonsal.

Zymologia Chymica, or a Discourse of Fermentation,
from a new Hypothesis of Acid and Sulphur; with an
Appendix of the Sulphur-Bath at *Knarborough*: by
Dr. Simpson.

*Bathonensium & Aquisgranensium Thermarum Compara-
tio ; variis adjunctis illustrata*, per R. P.

*Observations sur les Eaux Minerales de plusieurs Provinces
de France, faites en l'Academie Royale des Sciences, en l'anné
1670 & 1671. Par le Sieur du Clos ; in Lat. by Dr. Mo-
limbrochius; and in English by Dr. Sherly.*

Martin. Lister de Fontibus Medicatis Anglia.

De Origine Fontium, per R. Plott.

Mr. Boyle's Memoirs for the Natural History of *Mineral Waters*.

*Phibisologia Lancastriensis ; cui accessit Tentamen Philosc-
phicum de Aquis Mineralibus.* By Dr. Leigh.

*Tractatus de Salis Cathartici amari in Aquis Ebishamen-
sibus & hujusmodi aliis contenti Natura & Usu*, by Dr.
Grew.

*De Fontium Mutinentium admiranda Scaturigine Trac-
tatus Physico-Hydrostaticus*, Bernardini Rammazzini. En-
glished, with Remarks and Experiments, by Dr. St.
Clair.

Hydrologia Chymica, or the Chymical Anatomy of Scar-
borough and other Spaws in Yorkshire, &c. by Dr. Simpson.

The natural History of the Chalybeate and Purging
Waters of England, with their particular Essays and Uses:
&c. With Observations on the Bath Waters in *Somerset-
shire*, by B. Allen, M. B.

The Ancient $\Psi\chi\rho\omicron\lambda\omicron\tau\epsilon\iota\alpha$ revived: or an Essay
to prove cold Bathing useful and necessary, in four
Letters: with a Discourse of the wonderful Virtues of
Bath Waters on decayed Stomachs drank hot from the
Pump. by Sir John Floyer, and Dr. Baynard.

Dr. Guidot's Discourse of Bath: and his Observations.

Dr. Cheyne on the Bath Waters.

Dr. Wynter of Bathing in the hot Wells at Bath.

Dr. Oliver on the Bath-Waters, &c.

veral *Medicinal Springs*, of which no tolerable Account has been given. Thus the *Holt Waters* are but of late date among us; and even the Springs near *London* seem to have been greatly neglected; infomuch that there is no exact History given of the *Water in St. George's Fields*, said by Dr. *Baynard* to cure *Cancers*. What he says of this *Water* is highly remarkable; and tho' the Character of that Gentleman be somewhat exceptionable; yet the Confirmation I have, from other Hands, received of this extraordinary Virtue in these *Waters*, as having lately cured two ulcerated *Cancers* in the Breasts of Women, may render his Relation more credible*.

Nor

* The Doctor's Words are these. " A Physician of good Learning and Reputation told me, that he knew a *Smith* in *Yorkshire*, who had a *Cancer* in his Right-side, that had eaten the Flesh to the Ribs, and as broad as the largest Man's Hand, who was perfectly cured by Bathing in a Mineral Water, and keeping a Cloth wet in the same Water to it.

" *Amphillis Brown*, of *Hall-Court*, within three Miles of *Bromyard*, in *Herefordshire*, by drinking and Washing in a cold Spring near *Bridgnorth*, was cured of a *Cancer*, about two Years since. Both wonderful Cures! if true *Cancers*; which I very much doubt, because I have often heard the most eminent Surgeons affirm, that they never knew a true and confirmed *Cancer* ever was cured. But to invigorate these two Relations of *Cancers*, take this late one, which I myself know to be true.

" One Mrs. *Margery Bolton*, Wife to Mr. *Edward Bolton*, belonging to the *Queen's Audit Office*, received, some Years since, a Blow with the Key of a Door, somebody opening the Door suddenly, and she behind it; which Blow pained her much at first, but afterward it seemed tolerable, but not totally receded; but in some Time it grew worse and worse; at length it grew big, grumous and hard, and pained

Nor have the new *Tunbridge-Wells*, near *Islington*, nor the *Pancras-Wells*, been properly examined. If we go farther from *London*, we hear of Medicinal Springs in abundance; as particularly in *Gloucestershire*, and *Staffordshire*; where there are several Waters said to cure the *Leprosy*, *Dead-Palsy*, and other Distempers vulgarly accounted incurable: whence there is evident-

“ her very much, and at last *exulcerated*: she had the
 “ Advice of several eminent *Surgeons*, who all viewed
 “ it, and concluded that it was an incurable Cancer.
 “ About *January 1707*. I was desired to see her, I be-
 “ ing acquainted with her Relations: I knew her from
 “ a Child. I declare that the Room smelt so fetid and
 “ cadaverous, that I was not able to endure it. She
 “ told me that she was in a dying Condition, and that
 “ she should never see me more, and truly I thought
 “ so; she was so emaciated and worn away, that I
 “ wished her a comfortable Passport into the other
 “ World, and so took my leave of her. In *April* fol-
 “ lowing I casually met her Husband in the Street, and
 “ I asked him how long his Wife lived after I saw her?
 “ He smiled, and said, she was alive and well; at which
 “ I being astonished, presently went to see her. I
 “ found her about her House, in her Business, and re-
 “ ceived me with a chearful Countenance. I ask’d
 “ how she came by that wonderful Cure? She told me,
 “ by taking constantly a *Mineral Water* in *Southwark* at
 “ or near the *Dog and Duck*, which purged her much
 “ at first, and keeping a wet Cloth dipt in the same
 “ Water always to her sore Breast, at length the pu-
 “ trefied Lump of the cancerated Matter separated
 “ from the sound part of her Breast, and hanging on-
 “ ly by some few Filaments, which she clipped off with
 “ her Sizzars, it fell to the Ground, like a piece of
 “ corrupt Liver; and applying a Pledget of *Ung. Basi-*
 “ *licon* to that part where she clipped off, was very soon
 “ cured. I think this is the sum, if not the whole
 “ she told me; but if any Body would be farther satis-
 “ fied, she lodgeth at a *Shoemaker’s-shop* in the little
 “ Passage between *Fermyn-street* and *Piccadilly*, very near
 “ *St. James-Church.*” *History of Cold-Bathing*, Ed. 1722.
 pag. 316—319.

evidently wanting, *a History and Examination of the less frequented Mineral Springs of England; with a View to Medicine and other Arts; derived from direct Experiment and Observation.*

10. And besides the Springs already known in *England*, we have great Assurances, that there remain others still undiscovered. The excellent Mr. Boyle, upon this Head, delivers himself thus. “I look upon the Examen of the

*The En-
quiry after
New
Springs
recom-
mended.*

“ Properties, and other Qualities, of *Mineral Waters*, as a thing that is, therefore, of the greater Importance, because I am apt to think, upon probable Grounds, that, by a diligent Enquiry, there may be discovered in *England*, (and in divers other Countries too) a far greater Number than is yet imagined of *Mineral Waters*, especially ferruginous ones; which I therefore guess will be very numerous, because, by some uncommon ways of Trial, that I have employed, I have found that divers Minerals, that either Men knew not what to make of, or, by Reason of their passing under other Names, did not suspect to be martial, did yet partake of, and perhaps abound with, Parts of a martial Nature. And I shew in another Paper, that kindly provident Nature, or rather its Divine Author, has, under various Disguises, furnished our Globe with a far greater Plenty and Variety of Iron-Ores and Minerals, that partake of that Metal, the most useful by far to Mankind, than of any other Metal. And as martial Minerals do thus abound in the Earth, so they are more disposed, than one would suspect such hard Bodies could be, to impregnate even such Liquors as are not manifestly acid, and

“ seem unlikely to be able to work upon
“ Minerals, far less hard than they.”

11. A Discovery of *Steel-Waters* seems to be a capital *Desideratum*; for of the purging kind there is great plenty already discovered; and if, upon proper Search, a few Springs shall be found, in different Counties, of the same Virtues and Efficacy as the *German-Spaw* and *Pymont-Waters*, such Discoveries might prove of more Service to the Nation, than the Discovery of Mines. And to this Purpose proper Directions might be given to reduce the Discovery of *Mineral Springs* into a kind of Art; like that practised in the Discovery of Mines. And thus a new Business would, in time, be formed, and Essays, or Proof-Trials taken of all such Waters, to shew their Contents, their Virtues, and their Uses; with regard not only to Medicine, but other Arts; as particularly Tanning, Dying, Soap-boiling, Brewing, Bleaching, Callico-printing, Alum-works, Vitriol-works, Pottery, Stone-works, &c. according to the Nature of the mineral Matters such Waters abound with.

12. An *Enquiry* of this kind seems not only practicable and useful in itself, but will, if regularly conducted, that is, in the rational way, of an Art, naturally lay the Foundation of a *Philosophical Account of the Springs of England*; shewing,

(1.) Their Origin, Course and the Nature of the Beds they wash.

(2.) The Cause of hot Springs.

(3.) The Nature and Production of *Alum*, *Vitriol* and *Sea-Salt*.

(4.) The Relation betwixt *Earth*, *Salt* and *Water*.

(5.) The Origin, and farther Uses of *Marcasies*, *Iron-Ore* and *Iron-Stone*. The

(6.) The Nature, or Form, of *Water*, in all its different Species.

(7.) The perfect Ways of *Imitating all Natural Springs*.

(8.) *New Uses of Mineral Waters*, resulting from this Enquiry, &c.

13. To set this Design on Foot, we shall here make some little Attempt, by way of Specimen; to shew how every one may contribute towards *an Examination of the Mineral Waters of England*. And First, to point out the general Method of Proceeding, it may be proper to give an eminent *Example*, from a curious Hand. *viz.*

An Account of a Mineral Water near Canterbury, by Dr. Scipio des Moulins; Published in the Philosophical Transactions, N^o. 312. An. 1707.

1. **A**BOUT twelve Years ago a *Mineral Water* was accidentally discovered here. In digging the Ground, they first met with a fat, black Mould, reaching three Foot deep; and gradually changing into another sort of Earth, very fat, and like Butter. This second Layer was two Foot thick; the Colour yellow, something mixt; its Odour strong and mineral: and a Piece of it being for some time exposed to the Sun, it smelt like burning Sulphur. After this they found a Quick-Sand, of a darker Colour than the first Earth; mixt with several little Stones; and the Smell still stronger than before. Two Foot farther, under the Quick-Sand, a hard Rock appear-

*The Beds
of the Mi-
neral
Spring.*

ed; out of which Water gushed with some violence. They dug five Wells, about seven Foot distance from each other; one about eight or nine Foot deep from its Surface, and twelve from the Surface of the Ground about it, and reaching the Rock: the other is not so deep by two Foot, and only touches the Sand. This last is something stronger of the Sulphur; but the other is stronger of the *Mineral Spirit*, and *Irony Parts*.

2. Two Drams of the second Layer of Earth, found in digging, being put into four Ounces of *Spirit of Vinegar*, there presently arose a considerable Ebullition; and soon after the Spirit was tinged with a yellow, brownish Colour, which suffered no Alteration with the Infusion of Logwood, nor with Galls; but with Oil of Tartar *per deliquium* it turned greenish; and with the Infusion of *Lig. Nepbrit.* of a pale Red.

The Water examined at the Spring-Head.

3. The Water, taken up at the Spring, is extremely limpid, but grows something whitish in a quarter of an Hour; and in half an Hour the *Spirit* is lost; and the *Mineral* hangs first on the sides of the Glass, and then falls gradually to the bottom. It will not keep quite so well as the *Spaw*, or *Tunbridge Water*. Its Taste is harsh and austere; the Smell ferruginous and strong, something upon the Sulphur: People say it smells like Gunpowder. It will make the Root of the Tongue of the Drinker blackish. Linen washed in it turns yellow. It will not lather with Soap. The Glasses the Water is dipped with grow yellow; which no scouring can take off; and are apt to fly. In frosty and cold Weather 'tis so warm as to melt Ice and Snow; in other Seasons 'tis cold, tho' not so cold as some Spring-Waters are.

4. The

4. The Weight of this Water varies great- *Its Gravity* ly, according to the Seasons and Weather. In *and change* May 1704, it weighed three Grains lighter *of Colour* than common Water, in the Quantity of a *by Mixture* Pound. In the Spring of 1705, it was equal in Weight to common Water; but was still heavier in the *August* following, because of the exceeding dry Weather that Summer. But in general, about Midsummer, if the weather is no ways extraordinary, 'tis nearly equal in weight to common Water. A single Grain of good Galls will instantly turn a Pint and a half of this Water to a deep red. *Syrup of Violets* turns it of a grass-Green. With the *Infusion of Brazile* it gives a deep lively blue: with that of *Lign. Nephr.* first a light green, then a light yellow: with the *Infusion of Logwood*, a blue black: with that of *Fustic-wood*, a dusky yellow: with the *Flowers of Pomegranate*, a fair violet: with *Tea-leaves*, a fine purplish blue: with good *Nantz-Brandy*, an elegant Sky-colour. It instantly turns a *Solution of Sugar of Lead* milky; and a *Solution of Sublimate* also, in some small time. *Oil of Tartar per deliquium*, *Spirit of Sal-ammoniac*, and *Spirit of Vitriol*, make no sensible Alteration.

5. In calm Weather, in Winter especially, *Its unctu-* a thick oily Film covers the Surface of these *ous Sub-* Waters, with as great a variety of Colours as *stance.* the Rainbow. A Spoonful of this oily Matter drank, has the Effect of, and composes as much to Sleep, as a moderate Dose of *Opium*. Some of this Scum, being dried by Evaporation, tasted very fat; and felt so between the Fingers. Some of the Powder being cast upon a red-hot Iron, most of it immediately burnt away with some sparkling; and what remained was of the Colour of Rust of Iron, and tasted

tasted partly styptic and earthy, and partly saltish.

Its Sediment.

6. The *Water* itself, being gently evaporated, yields a yellowish Sediment, more or less according to the Seasons. Last Spring a Quart yielded six Grains of it ; but in *September* following, the same Quantity afforded nine Grains : whereas a Pound of *Tunbridge Water* gave but a single Grain of Sediment to Mr. *Boyle* ; as appears by his *Memoirs of Mineral Waters*. This Sediment being boiled in common Water, made a strong *Lixivium*, with which *Acids* caused no sensible Fermentation ; but *Syrup of Violets* turned it green. This *Lixivium* being evaporated, yielded a fat sulphureous Salt, that would not coagulate into Crystals. I can get but three or four Grains of it out of ten Grains of Sediment ; but from the Colour and Taste of the *Lixivium*, I suspect, that there is a larger Proportion of saline Particles, which, I conceive, being volatile, evaporate with the Water.

Its Medicinal Virtues.

7. As for *Medicinal Virtue* ; from the many and wonderful Cures they perform, I believe them one of the most excellent Waters of this kind, yet discovered in *England*. The *little Well* is very useful in Diseases of the Breast ; as *Asthma's*, *Coughs*, *Rheums*, and *Catarrhs*. It has cured several that were given over in Consumptions of the Lungs. Most Disorders of the Stomach are cured by this *Water*. It seldom fails in Rheumatic and Gouty Pains of the Limbs or other Parts ; in the Scurvy, Melancholy, Jaundice, Vapours, all sorts of Stoppages, Scabs, Itch, &c. But in the Gravel, Colick, and Green-sickness, 'tis a true Specific ; as also in inward Ulcers, if not too far gone.

A Pot-

A *Potter* in *Bolton*, who had spent his Substance on Doctors, and was last Spring discharged out of *St. Thomas's Hospital*, as an *Incurable*, was cured of an Ulcer in the Bladder this Summer, by drinking of this Water for three Months together. In Agues 'tis beyond the Bark: I have seen some rebellious ones, that could not be removed by the Bark, perfectly cured by this Water; and some Constitutions quite worn out, by frequent Relapses of this Distemper, restored. This is also remarkable, that it agrees both with old, decayed, and weak Constitutions. The Water sits pleasantly upon the Stomach, works off by Urine very briskly, causes a good Appetite, cheers the Spirits, and procures Sleep. 'Tis not binding, as some other Chalybeates are, but keeps the Body open, in most People; and upon some it brings now and then a gentle Looseness, which carries off the Distemper. For these four Years I have prescribed it to many sorts of People, every Season; and I could never observe any Inconvenience, or ill Symptom arise from the drinking of it.

So far *Dr. des Moulins*: We next proceed to give a few short *Examples* of our own.

*The HOLT WATERS examined, at London,
in April 1731.*

1. **T**HIS *Water*, procured of Mr. *Eyre*, Purveyor of *Mineral Waters* to the *Queen*, and examin'd in *London*, changed not its Colour with *Galls*; and consequently holds no *irony Matter*.

2. It made no Conflict with *Spirit of Sulphur*; nor caused the least Alteration in *Syrup of Violets*: whence it is not manifestly *alkaline*.

3. It immediately turn'd milky with *Oil of Tartar*, and slowly let fall a very light and white *Precipitate*, tho' in no large Quantity; and consequently contains a small Proportion of a *fine earthy Substance*.

4. It changes not the Colour of *Silver*; and consequently holds no *Sulphur*.

5. Upon evaporating three Pints thereof, in a Pewter Vessel, over a Spirit-Lamp*, it left half a Dram of a *white, dry Matter*; that tasted a little saline, and lightly bitter; but did not dissolve in cold Water: whence this Matter is chiefly *terrestrial*.

6. This dry Matter laid upon a hot Iron, does not rise light and spongy; and consequently is not *aluminous*.

7. Upon adding *Oil of Vitriol* to a parcel of this *dry Matter*, it affords not the pungent Odour of *Spirit of Salt*; but rather that of
Aqua

* All *Waters*, neither manifestly *acid*, nor *alkaline*, may safely be evaporated in a Pewter Vessel: tho' 'tis always proper to mention the Vessel, the Furnace and the Fuel employ'd; because sometimes these Particulars may considerably alter the Success of the Experiment.

Aqua fortis : and consequently there is no *Sea-Salt* in this *Water* †.

8. Hence this *Water* is a *neutral Fluid*, abounding largely in a properly *aqueous Part*; very sparingly in *saline Matter*; and but moderately with a fine *white Earth* *.

9. The *Holt Waters* therefore seem, *à priori*, not considerably purgative; but well fitted for a Diuretic, an Alterative, a Sweetner, and a Dryer; and are consequently proper in ill Habits of Body, foul Juices, old Ulcers, running Sores, &c. And by just Reasoning from an exact Knowledge of the Causes of Diseases, and these kind of Experiments, may not the Virtues and curative Effects of all *Waters* be satisfactorily deduced?

10. As the medicinal Virtues of these *Waters* appear principally owing to the *pure Water*, and *subtile, saline Earth* they contain; may not this afford an useful Hint for introducing Medicines of that kind into Physic?

11. It is remarkable of this *earthy Matter*, that tho' it dissolves not in *cold Water*, yet it readily dissolves in the Mouth, like a *neutral Salt*: And hence may appear the Affinity betwixt *Salts* and *Earths*; or, as we learn from many other Experiments, that *Earths* reduced to a certain Degree of Subtilty, become *Salts*; and, *vice versâ*, that *Salts* may readily be converted

† From the two preceding Experiments, is not this dry Matter a Species of Dr. Lister's *calcareous Nitre*? If so, it may lead to a considerable Discovery. See hereafter, § 12.

* For want of Conveniencies, I did not separate the properly *saline Matter* from the mere *Earth*; so that these Experiments are not driven far enough, to determine the precise Nature of the Salt of the *Holt-Waters*. Nor are the *Indications* of Dr. Lister's *calcareous Nitre*, and its Uses, sufficiently understood.

verted into *Earths*; as Mr. *Boyle* has tried. And as every *Earth* is convertible into a *Salt*; of a Nature determined by that of the *Earth*; we are instructed to allow a specific Difference in *Earths* as well as in *Salts*; and not to imagine they have no specific or determinate Virtues in Medicine.

12. Some uncommon Experiments, made with the *earthly Matter* of these *Waters*, afford Intimations of its being the *Earth of Silver*; and by a proper Encheiresis convertible into that *Metal*. Those who understand *Becher's Physica subterranea* will know the Meaning of this; and the philosophical Doctrine it paints out.

The PANCRAS WATER examined, at the Spring-Head, and at London; towards the end of March. 1731.

1. **T**HIS *Water* alters not its Colour, upon the Spot, with Tincture of *Galls*; and consequently holds no *irony Matter*.

2. It makes no remarkable Conflict with *Spirit of Sulphur*; but changes *Syrup of Violets* somewhat green: and consequently is rather *alkaline* than strictly *neutral*.

3. It turns milky, curdly, and deposites a copious, white Sediment with *Oleum Tartari per Deliquium*: which shews it contains a large Proportion of *Terrestrial Matter*.

4. It proves somewhat bitter, as well as quicker to the Taste, upon the Addition of *Spirit of Sulphur*; so as by this means to resemble

seemle the more common *Purging Waters*, viz. those of *Aston*, *Dulwich*, &c*.

5. Upon evaporating a Gallon of this *Water* in a Glass Vessel and Sand-Heat, it left near three Quarters of an Ounce of *dry Matter*.

6. *Oil of Vitriol* dropped upon this *dry Matter*, raises the Fume of *Aqua fortis*; consequently it holds not a *Sea Salt*, but, perhaps, the *calcarious Nitre* of Dr. Lister †.

7. These *Pancras Waters* are not very disagreeable to the Taste; prove considerably diuretic and purgative; so as to become of Service in the *Stone*, *Gravel*, &c.

8. Cannot this *Pancras Water* be regenerated, by dissolving the *dry Matter* in a *pure Water*; with the Assistance of some proper *Encheiresis*?

9. What are the constituent Parts of this *dry Matter*; and what are its Uses in Medicine, and other Arts? If it hath any considerable ones, it is procurable in a large Quantity.

10. Does not this *Water* appear to have somewhat particular in it, different from most other *Mineral Waters* of *England*? And wherein does this Particularity reside?

11. To go farther, have not most *Mineral Springs* somewhat peculiar, so as to be, in a proper Sense, specific, or adapted to the Cure of

* The addition of *Spirit of Sulphur*, or *Spirit of Vitriol*, to any mineral, diuretic, or gently *purgative Water*, abounding so much with earthy Matter as this, may perhaps render it more purgative; by dissolving the earthy Particles, and converting them into *neutral Salt*: which seems to be the real Effect upon such an Addition.

† This deserves to be farther examined, and may be brought to a Determination by Solution and Crystallization.

of one Set of Diseases, better than another ; and is it not possible by Art and Application to discover what *Springs* are specific in what *Diseases* : or need this Matter still be left to Chance and casual Experience ?

12. Does not this slight Examination of the *Pancras Waters* shew the Affinity betwixt *Earth* and *Salts* ? It is pleasant to observe, when the Addition of *Oil of Tartar* has precipitated the light *Earth* of these *Waters*, in a large Proportion, how by the Addition of *Spirit of Sulphur*, that *Earth* is again dissolved; the turbid Mixture rendered clear and bright ; and a *Water* with the pungent, quick Taste of the *German Spaw Water* procured ; tho' without the styptic, irony Part.

*The SCARBOROUGH WATER examined, at
London, in April. 1731.*

1. **A** Bottle of this *Water*, that was well sealed down, did not sparkle upon being opened, nor taste brisk and pungent ; but somewhat bitter and nauseous, like the *Pancras Water*.

2. It did not turn in the least purple with green Tea Leaves ; and instead of turning black, as was expected, with Galls, it gave a thick Whiteness, and slowly precipitated a copious white Powder.

3. It made some small Conflict with *Spirit of Vitriol*, and turn'd *Syrup of Violets* to a beautiful green ; tho' somewhat inclined to blue at the first.

4. With

4. With Oil of Tartar *per Deliquium*, it immediately curdled, and let fall a copious white Precipitate.

5. Upon evaporating a Quart of this *Water*, it left almost a Dram of dry Matter; greatly resembling that gained from the *Pancras Waters* above-mentioned.

6. And indeed the Trials made upon the *Pancras Water*, after having been kept for some time in Bottles, compared with those made upon this *Scarborough Water*; have such an Affinity, in most respects, that had I not received the *Scarborough Water* from a worthy Gentleman of *Scarborough*, I should have thought myself imposed upon.

7. It is very remarkable, that none of our *Experiments* shew the least Signs of *Vitriol*, *Iron*, *Alum*, *Nitre*, or *Salt*, in these *Waters*; all which Dr. *Wittie* declares they contain. See his *Description of the Nature and Virtues of the Spaw, at Scarborough*; published in the Year 1660.

8. One should not however draw hasty Consequences from a slight Examination of these *Waters*, so remote from their *Spring*; but certainly some proper Persons should examine a *Spring* of this Note, with the requisite Care and Skill, upon the Spot: for the Notions commonly entertain'd of it, even by such as prescribe its Use, square very little with our *Experiments*.

9. It should seem, that the principal Virtue of these *Waters* resides in their *Salt*; which, whether it be any other than Dr. *Lister's calcarious Nitre*, I have not yet examined: but the dry Matter runs, and rises in Blebs upon a hot *Iron*, like the *calcarious Nitre*.

Q

10. The

10. The more certain way of determining this Point, is to dissolve the dry Matter gained by Evaporation, in *hot Water*; filtre the Solution, and set it to crystallize; and then to compare the Shoots, either with the Doctor's Description, or the common *Nitrum Murale*: as by laying both upon a hot Iron, to see if they rise in Blisters; and submitting them to the Judgment of the Senses, and the proper Experiments, by *Addition*.

The new TUNBRIDGE WATERS, near Islington, examined, April 12. 1731.

1. **T**HIS *Water*, fresh taken up at the *Spring-Head*, did not now throw up so many Bubbles as in the *Summer*, nor smell so quick, nor taste so brisk *.

2. A Glass of it fresh taken up, turn'd, with a few Leaves of green Tea, of a bluish Purple, like a dilute Tincture of *Field Violets*; thus

* If this be constant and regular, the *Water* must abound differently in *Mineral Spirit*, at different Seasons of the Year. The *Faët* deserves to be carefully examined; and the *Air-Pump* is an useful Engine in the Enquiry. A Determination of this Point would direct the Use of these *Waters* according to the Seasons. Thus in *Summer*, the *Spirit*, then plentifully abounding in them, is manifestly too potent for many; especially the sanguine; and makes the Head giddy, and dull, or inclines to sleep. To remedy this is easy, by the addition of pure *common Water*; but then the Proportion of the *alkaline* and *irony Principles*, is also lessened, as the aqueous one is increased; so that, perhaps, some Persons might drink them to better Advantage in the *Winter* than in the *Summer*.

thus exhibiting a Colour of great Beauty and Brightness *. Another Glass, with a very small Proportion of *Galls*, turn'd first of a light Crimson, that gradually changed to a red Purple, and at length into a thick and muddy black.

3. The addition of *Spirit of Sulphur* made no apparent Conflict; but *Syrup of Violets* changed to a beautiful Grass-green.

4. This *Water* curdles not in the least with Milk, neither cold nor boiled over a naked Fire †.

5. It turns but very little milky with a large Proportion of *Oil of Tartar, per Deliquium*; and scarce lets fall any Sediment.

6. It is observable of this *Water*, that it stains the drinking Glasses of a durable yellow, not easy to be got off; and that it tastes irony, or somewhat styptic; which are Indications of its chalybeate Nature: and this
Q 2 appears

* Dr. Stare's Observation on the *Pymont Waters*, compared with these, deserves to be considered. He says, that " none of our *English Steel Waters* strike such a purple Colour as the foreign: for ours give a more turbid and dark Colour; and the worse the *Waters* are, the blacker Sediment they make. Those of *Islington* abound with a coarse Oker; the Mineral here not being well dissolved, but giving an atramentarious Colour; but the *Pymont* excel all I have happened to examine, in its bright, cæruleous Lustre." *Philosoph. Transact.* N°. 337. The Examination here mentioned, appears to be that with *Tea-Leaves*; but in my Trials, both at the Spring-head, and in *London*, the *Islington Water* struck an exceeding bright and beautiful Purple, with *Tea-Leaves*.

† This, tho' a slight Experiment, is of great Use; as shewing not only the alkaline Nature of these *Waters*, but also their suitableness to mix with the animal Fluids, dissolve Coagulations, cure Consumptions, &c. especially when drank along with Milk.

appears farther confirmed by the Oker deposited near the Confines of the *Spring*; some of which I collected, but did not melt it into *Iron*; as it probably might be.

7. Two Bottles being filled at the *Spring-Head*, and one of them carefully pitched down, the other stopped loosely with Cork, and brought to *London*; they both of them soon turn'd thick and turbid, and deposited a light Sediment, in a considerable Quantity.

8. The Bottle loosely stopped, had in two Days lost its brisk Taste, and its Faculty of striking a Colour with *Tea-Leaves*, or *Galls*; and turned but very lightly green with *Syrup of Violets*: whence it should seem, that the *alkaline Salt* of these *Waters* is volatile.

9. The Bottle carefully pitched down, was now become fine again, upon depositing its Sediment; and being opened, tasted quick, turn'd purple with *Tea-Leaves*, and inky with *Galls*, as strongly, to appearance, as at the *Well-head*. Nor did it seem by the addition of *Syrup of Violets*, or by any other Trials, to have lost of its Virtue.

10. From whence proceeds the Sediment which this *Water* lets fall in plenty upon standing; and what is its Nature and Uses? Does not this Sediment fall for want of a sufficient Quantity of *Spirit* in the *Waters*, to keep it suspended; whence they are naturally overloaded with an irony Matter?

11. And may not the *Water*, in some Cases, be used to better Advantage, without this Sediment; and so, after Defæcation, be drank to better Advantage at home?

12. Cannot this *Water*, by a slight *Encheiresis*, be made to resemble that of *Pyrmont*, or the *German Spaw*? viz. by the addition of a
proper,

proper, volatile, or fixed Acid and Alkali, the latter whereof to predominate; as may be exactly determined, for Use, by Syrup of Violets?

13. May not these *Waters* be artificially strengthened in the Winter, Autumn, and the Spring; or rendered more spirituous by the like addition, so as to be drank to more Advantage in those Seasons, by Persons of some Constitutions?

14. Which is the best Method of rendering these *Waters* still more innocent and serviceable; whether drinking them crude, as they are taken up, or after depositing their Sediment? Whether by warming them, with some particular Caution to keep in their Spirit; or, by the addition of boiling Milk? Whether with Exercise, or without, &c?

15. To conclude, do not the *Waters* of a *chalybeate Spring*, of this apparent Consequence, so near *London*, deserve a careful Examination; both at the *Spring-head*, and after standing some time in Bottles, or proper Vases; so as to be commodiously drawn from the Sediment for Use?

These Examples may shew, that there is a certain way, by due Exclusion and Rejection, or by *Sets of negative and affirmative Experiments*, of coming at a Knowledge of the true Contents of *Mineral Waters*. And more than this they are not intended to shew: for they are, by no means, proposed as perfect Models, or absolutely conclusive; without being driven farther, and verified by repeated Trials, till they clearly and strongly express the Nature of the Thing; and conclude demonstratively.

And thus we hope to have intimated, how far this Enquiry into *Mineral Waters* has al-

ready been carried ; what is still wanting to its Promotion ; and how Men may, if they please, bring it to terminate in Certainty. To prosecute the Subject thoroughly requires several Hands, and a length of Time. No single Spring can be examined, to Satisfaction, in one Year. If better Hands do not, as we hope they will, prevent us, we may, perhaps, return to this Subject, after touching upon a few others ; which, tho' not less useful, remain less cultivated. We have gone through the Methods of Treating *inflammable Spirits*, and *Waters* : and shall proceed to *Wines*, *Oils*, *Salts*, *Earths* and *Metals* ; in the same way of *Experiment* and *Observation*.

E R R A T A.

PAG. 1. line 25. for necessity apply, read necessity to apply. p. 5. l. 11. for so to, r. so as to. p. 61. l. 21. for gently treated, r. gently heated. p. 128. l. penult, for *Homia*, r. *Holmia*. p. 210. l. 4. for *Observatoribus*, r. *Observationibus*.

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A

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